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TOJSAT welcomes you. TOJSAT would like to thank you for your online journal interest. The online journal system has been diffused very fast for last ten years. We are delighted that almost 172,000 educators, teachers, parents, and students from around the world have visited for four years. It means that TOJSAT has continued to diffuse new trends in science and technology to all over the world since January, 2011. We hope that the volume 8, issue 3 will also successfully accomplish our global science and technology goal.

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TOJSAT thanks and appreciate the editorial board who have acted as reviewers for one or more submissions of this issue for their valuable contributions.

TOJSAT will organize ISTEC-2018- International Science & Technology Conference (www.iste-c.net) between July 18-20, 2018 in Paris, France. This conference is now a well-known science and technology event. It promotes the development and dissemination of theoretical knowledge, conceptual research, and professional knowledge through conference activities. Its focus is to create and disseminate knowledge about science and technology. ISTEC conference books have been published at **http://www.iste-c.net/istecpubs**

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July 01, 2018
Prof. Dr. Aytekin ISMAN
Sakarya University

Message from the Editor

Dear Readers,

We have been publishing the Online Journal of Science and Technology since 2011. Audiences and readers of the journal is widening throughout the World and increasing especially after the conference series of Science and Technology. Tojsat journal is now indexed with Doaj, DergiPark Akademik, Cite Factor, Index Copernicus, Google Scholar, Worldcat, Sobiad, and Universitats Bıblıothek Leipzig and will be cited soon by Scopus index.

The journal favours papers addressed to inter-disciplinary and multi-diciplinary articles shown in the section of scopes. In this issue of the on-line journal, selected peer reviewed papers are published.

I will thank to the readers for their supports by sending their valuable scientific works to publish in this journal.

Prof.Dr. M. Şahin Dündar

Editor

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A COMPERATIVE STUDY OF SiC REINFORCEMENT EFFECT ON MECHANICAL AND PHYSICAL PROPERTIES OF Al2024-SiC AND Al6061-SiC COMPOSITES PRODUCED BY POWDER METALLURGY METHOD

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Abstract: In thıs study, metal matrıces composite samples, Al2024 and Al6061, has been produced by powder metallurgy. Their partıcle sıze are 40 µm and 45 µm respectively and 12.5 µm partıcle sıze SiC powder helping with powder metallurgy. The diameter of chrome steel ball used in technique was 10 mm and weight ratio was 6:1. A homogeneous micrp structures have been obtaıned after SEM observatıons. Physıcal and mechanıcal properties has been defined by theorıtically and experimentally. Also, porosity, hardness and thermal conductıvity of the composites have been ınvestigated ın thıs study. As a result, ıs has been achıeved that ıncreasıng of SiC content ıncreased the amount of pore ın composite and thıs ıncrease caused decrease ın the mıcrohardness.

Keywords: composite, powder metallurgy, SiC, hardness strength, porosity.

Introduction

Allthough metals are used commonly in many industries, technologıcal progress is increase day by day and the industries need more superıor feature materials then metals. This materials called by composite materials and manufacturing of composites are increased because of their success. Composite materials are more superior than metals and they are reinforced materials. High strength and able to work with high temperatures are most prefable properties are composite materials. Usage areas of composite materials are extended as their advanced properties and various manufacturing methods.

Composite materials are obtained by adding of second phase on the single component materials like metal, ceramic or polymer. When choosing reinforcement material of composites, should be consider of mechanical properties. Aliminum and Al alloys are used for matrice materials and SiC, B_4C , Al_2O_3 , are used for reinforcement element generally. SiC has high strength, resistance and high density so that prefable for reinforcement element in many industries.

Metal matrices composites, must have some advanced physical propertie such as high thermal conductivity, homogeneous micro structure, high strength for giving this properties to composites (Erdemir 2015). To specify properties of composites, there are some numeric and experimental methods. For instance, the hardness of samples are determined by Vicker Hardness method.

Al2000 and Al6000 series are commonly used series in metal matrices composites. Al 2000 series is consist of copper element. Strength of Al2000 is more than the others. Heat treatment processes are usable for this series. Al 2000 series are used frequently in aviation sector (Wu 2014).

On the other hand, Al6000 series contain Mg and Si elements. The most suitable series for aging process. Shaping ability is very high and after treatment, clean surface is obtained.

In lıterature, there are many theoritical and experimental studies about physical and mechanical properties of Al2000 and Al6000 series which are produced by powder metallurgy method. Mechanical and physical properties are played important role for determining microstructure of composites. Also, both of series have good mechanıcal properties and these are important parameters in production process and products.

In thıs study, the effect of SiC reinforcement on mechanical and physical properties of Al2024/SiC and Al6061/SiC composites produced by powder metallurgy method is researched, literature rewiev is done and results are disscussed and studied. In literature rewiev, based articles published in the year of 2015 and 2016 and

the obtained datas are timely. And finally, there are actual photos which are used in specify of mechanical and physical properties of Al2000 and Al6000 alloys (Ates 2011).

Materials and Methods

Ih thıs study, effect of SiC reinforcement on mechanical and physical properties of Al2000 and Al6000 series and the results are disscussed comperatively for both series.

SiC is used reinforcement element as average microsize 12,5 **µ**m, 40 **µ**m grain size Al2024 and 45 **µ**m Al6061. Their physical, chemical properties and compositions are given in the (Table1), (Table2), and (Table3) (Wu 2014).

Table 1. Physical and chemical compositions of Al2024 and Al6061 series.

Element	Cr	Cu	Fe	Mg	Mn	Si	Ti	Zn	Al
Al2024	0.10	5.3	0.5	0.4	0.3	0.50	0.15	0.15	Balance
Al6061	0.04-0.35	0.15-0.4	0.7	0.8-1.2	0.15	0.4-0.8	0.15	0.25	Balance

Table 2. Physical and chemical properties of Al2024, Al6061 and SiC.

		Al2024	**Al6061**	**SiC**
Physical properties	Density (g/cm^3)	2.83	2.7	3.22
Chemical properties	Thermal Conductivity (W/mK)	196	167	120

Tablo3. Chemical composition of SiC.

Element	SiC	Fe_2O_3	C	SiO_2	Al_2O_3
%	94.0	0.10	4.5	0.70	0.70

In the Erdemir and friends study, average size of 40 and 45 **µ**m, and %5 reinforcement rate of SiC is mixed to obtain homogeneous mixture and they used for production of Al2024-SiC and Al6061-SiC by powder metallurgy method. And then obtained compositions are grained at 300 rpm speed for 10 hours. Chrome steel balls are used and their radius are 10 mm. Powder weight ratio determined as 6:1 and grain process was done in toluen solution because of prevent oxidation. Finaly, grained powders collected to 2, 5 and 10 hours interval and graining process was completed. SEM photos before grain process of Al6061 and SiC powders are shown (Yao 2015).

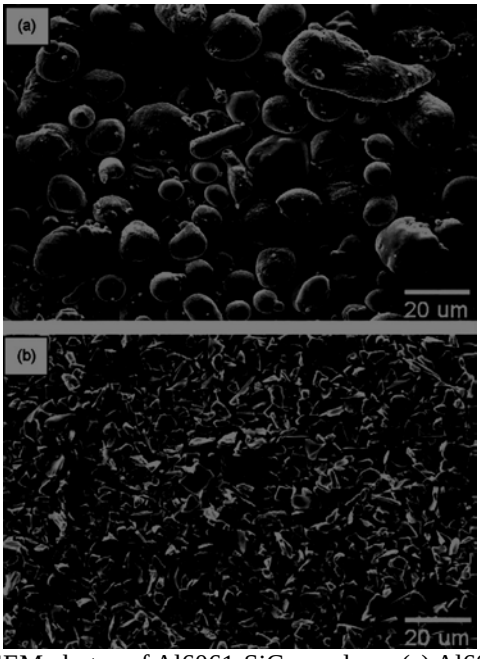

Figure 1. SEM photos of Al6061-SiC powders . (a) Al6061 (b) SiC

In the another study, Parvin and friends investigated Al2024-SiC and Al6061-SiC composites fracture surfaces produced by powder metallurgy with Scanning electron microscope (Hassani 2014). SEM pictures , which are showed in Figure2, its seen that grainin time is increased, composites are distributed homogeneously. Also, SiC was homogeneously distributed both Al series and increasing SiC reinforcement weight ratio, homogeneous structure obtained fast (Shaga 2016).

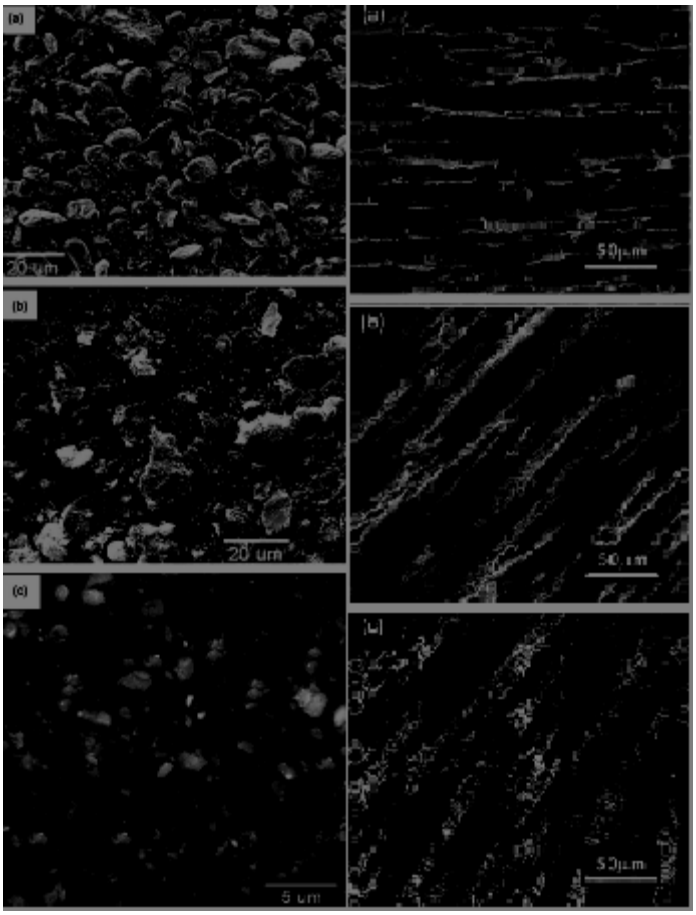

Figure.2 Al 6061-SiC ve Al2024-SiC composites's SEM photos. (a) 2, (b) 5, (c) 10 hours after graining.

Relative density measurement is done by Arshimed method comparing theoritical and experimental density, their values are nearly same. All of compiled studies given that theoritical density values obtained to %85-90. This results are good for this study.

Porosity measurements of components are done firstly calculation of theoritical density and then calculation of experimetal density of all component composites by Arshimed method. Secondly, porosity values are calculated by the formula (Cao 2016).

In the another study, X-ray diffraction specrtroscopy is used for microstructure characterization and determining phase distribution. SiC is added different weight ratios on composites, than XRD models are obtained both Al series. They are shown in Figure below. According to the models, microchemical structures and including element are determined also.

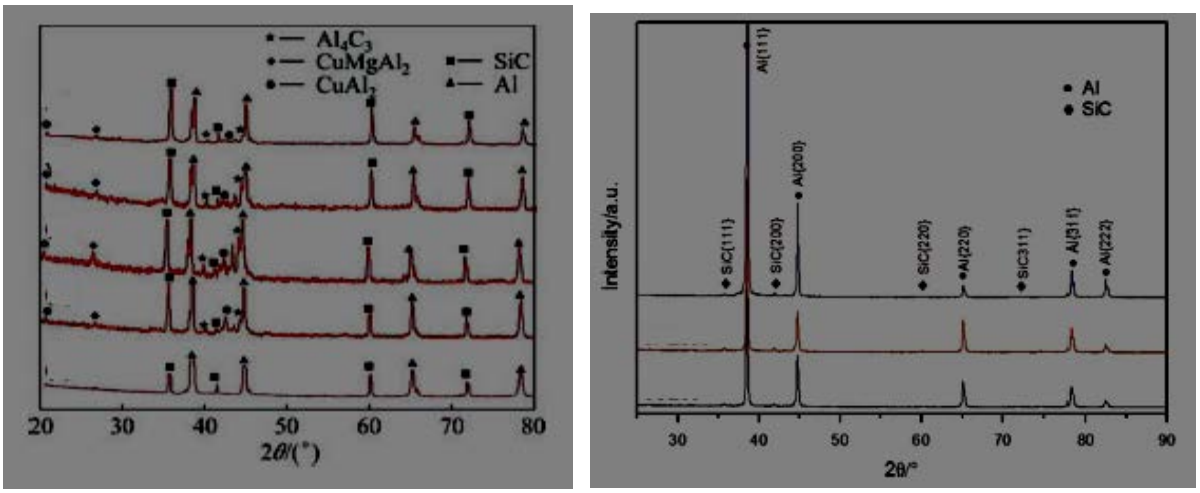

Figure.3 XRD models of Al6061-SiC ve Al2024-SiC composites in different weight ratios.

In thıs study, different analitical and numerical methods are shown which are used for determining physical and mechanical properties of metal matrices composites which is produced by powder metallurgy method. Also, density and hardness values are calculated byexperimental methods. Also, archimed method is used for determining porosity (Turkmen 2015).

Results and Discussion

In thıs study, effecct of SiC reinforcement on Al2000 and Al6000 series is investigated comperatıvely and lıterature rewiev collected and results are commented.

After studıes, Its clear that weıght ratıo of SiC reınforcement is affected porosity durıng productıon process of Al2024-SiC and Al6061-SiC composites. When, %5 of reinforcement volume ratıo of SiC ın metal matrix is increased, porosity of Al2024 is increased whereas porosity of Al6061 is decreased. For this reason Al6061 series has more clean surface than Al2024 series after heat treatment process.

Hardness experimentals of materials in compiled studies are done by Vicker Hardness testing method. The resul of experiments show that, ıncreasing amount of SiC is decreased hardness of material on Al6061-SiC composite. On the other hand, maximum hardness value of Al2024-SiC composite is obtained with %30 SiC weight ratıo ın composite. As, shaping processes are used frequently on Al600 series, decreasing hardness values are good charactheristic. On the series of Al2000, resistance strength is much more and this is important for industries.

Table.4 Hardness experiment of Al6061-SiC composite and percent porosity results.

SiC(vol%)	SiC size(µm)	Al6061 size(µm)	Hardness (VH)	Density (g/cm^3)	Theoritical density (g/cm^3)	Porosity (%)
45.8	12.5	45	153	2.73	2.93	0.932
55.9	12.5	45	86	2.61	2.98	0.874
66.3	12.5	45	42	2.44	3.03	0.803
45.8	12.5	45	176	2.78	2.93	0.969
55.9	12.5	45	155	2.71	2.98	0.898
66.3	12.5	45	67	2.42	3.03	0.833
45.8	12.5	45	157	2.84	2.93	0.950
55.9	12.5	45	135	2.68	2.98	0.909
66.3	12.5	45	47	2.53	3.03	0.797

Table.5 Hardness experiment of Al2024-SiC composite and percent porosity results.

SiC(vol%)	SiC size(µm)	Al2024size(µm)	Hardness (VH)	Porosity (%)
30	12.5	40	170	0.5674
40	12.5	40	225	0.5978
50	12.5	40	205	1.3811
60	12.5	40	180	2.0272
30	12.5	40	132	0.061
40	12.5	40	163	0.1925
50	12.5	40	155	0.2445
60	12.5	40	145	0.2015
40	12.5	40	175	0.59007

Finally, thermal conductivity of composites are studied experimental and theoritically. The result of experimental works, increasing SiC weight ratio, thermal conductivity of materials are increased both series. When the Al and SiC are combined in two series, thermal conductivity is reached the peak. Increasing thermal conductivity is contributed to both series of Aliminum for heat treatment processes.

SEM photos of composites show that SiC is dispersed in Al metal and its behaviour is appropriate for theoritical models. There is no heterogeneous wiev on Al2024-SiC and Al6061-SiC.

In compiled works, its clear that density of composite materials which are produced by powder metallurgy method, reach %85-90 of theoritical densities. Also, with high temperatures there is no change in micro structures of Al-SiC composites.

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A MODEL SUGGESTION FOR TRAUMA AND PSYCHOLOGICAL PROCESS LIVING PEOPLE AFTER EARTHQUAKE

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Abstract: In geology, “Earthquake” refers to the shaking of the earth’s surface caused by the spreading of seismic waves suddenly resulting from breaks in the earth's crust. In fact, an earthquake is a natural phenomenon that shows that everything on earth deemed immobile by people can be damaged. Unfortunately, are people not only unfamiliar with nature but also in the habit of underestimating it. 92% of Turkey is located in the seismic belt. What is more, 95% of the population, 98% of the industrial centers and even 93% of the dams are located in the seismic belts. Since the Erzincan earthquake that took place on December 26, 1939, 1139 people have lost their lives, 2543 people have been injured and 7049 buildings have been completely destroyed every year on average and a devastating earthquake has occurred once every 1.1 years. Although there is not much to do when faced with the reality of earthquakes in Turkey, at the core of this study is an enquiry into a model which will be a guideline for earthquake survivors moving forward with their lives and psychological support provided to them by professionals. The purpose of this model is to assist earthquake survivors to rebuild their post-earthquake private and social lives.

Keywords: Earthquake, Natural Phenomenon, Survival, Psychology, Social Life

Introduction

Earthquakes that cause loss of life and property are the mass movements on the mantle of the earth caused by the flow of earth’s internal heat to the surface which leads to breaks in the earth’s thin crust.

Scientific studies on the prediction of earthquakes have continued in parallel with the speed of technological development for 76 years, particularly after the 1939 Erzincan Earthquake. Changes in groundwater levels and the amount of radon gas and differences in the static electric field reinforce the physical basis for earthquake prediction especially before major earthquakes. The 7.3-magnitude earthquake which hit China in 1975 was predicted based on the observed clues and many people's lives were saved. In addition, the Japanese Meteorological Agency announced that there could be an earthquake 90 minutes before the 7-magnitude earthquake in 1978 in Izu Oshima which survived it with minimum damage.

Historical (before 1900) and instrumental (after 1900) earthquake records indicate that throughout history there have been many quakes in Izmir and its immediate vicinity which contain many active faults. The impact on buildings of seismic waves of medium-sized earthquakes that occur on these faults will be amplified by the unsuitable conditions of the metropolitan area in terms of settlement. It is, therefore, inevitable that many buildings will be damaged by a possible earthquake e.g. an earthquake of magnitude 5.5. In addition, landslide sites will be at greater risk as was the case in İzmir earthquake in 1977.

Model Creation Method

Even if it is impossible to prevent the occurrence of this natural phenomenon, it will be possible to live with the reality of earthquakes when we realize the important role they play in the evolution of the earth. For this purpose, potential seismicity can be determined by multidisciplinary studies (e.g. Geological, Geophysical, Construction, Psychological Consultancy etc.).

Sampling and Study Group

Awareness-raising activities titled "Basic Disaster Consciousness" were carried out in İzmir and its immediate vicinity between 2007 and 2011 under the leadership of Izmir Governorship and in cooperation between Dokuz Eylül University, Institute of Marine Sciences and Technology and some public institutions and organizations. These awareness-raising activities have been continuing individually in accordance with the requests of

institutions since 2012. Within the scope of these studies, lectures were given at all levels of educational institutions, at public institutions, private companies of importance and places deemed appropriate by local authorities in villages. Different experts from the same occupational groups attended these lectures each time.

In the presentations, firstly, academicians addressed the question “what is an earthquake?” and explained the risk of earthquakes in Turkey in general and seismicity in İzmir in particular. Secondly, experts from the Chamber of Civil Engineers presented some information together with some visual elements pertaining to the current condition of “Our Buildings” and addressed the question “What Should We Do about Our Buildings?” Thirdly, expert trainers assigned by the Izmir Provincial Civil Defense Directorate shared their knowledge and experiences within the context of “What Should We Do before, during and after an Earthquake?” Lastly, psychiatrists and psychologists who are specialized in the fields of normalization of and psychosocial support for post-earthquake life delivered speeches and discussed these issues with attendees in a conversational tone.

Data Collection Tools and Application Methods

Due to the fault systems, large-and-small breaks and fractures, there have been and will be many destructive earthquakes in Turkey which is located in the middle of the active seismic belt of Alp-Himalaya. The most destructive earthquakes in Turkey occurred in Kocaeli-Istanbul, Erzurum-Erzincan, Adana-Antakya and Izmir; the places which have fertile alluvial soils and are densely populated.

For this study, the earthquake records that have been recorded by Kandilli Observatory and Earthquake Research Institute of Boğaziçi University since 1868 are one of the most important source of information which accounts for the earthquake risks in İzmir and Turkey. Another important source used in this study is the information on the website of Turkish Prime Ministry Disaster and Emergency Management Presidency which enables the real-time monitoring of seismicity in Turkey in general and Izmir in particular. In addition to these sources of information, seismic studies have yielded very valuable results which have provided both clarity and reliability on the data obtained by other sources.

The first attempt to classify active faults in Turkey was the inventorial Active Fault Map of Turkey (scaled: 1: 2.000.000) prepared by the General Directorate of Mineral Research and Exploration (MRE) which used the data collected until 1987. Detailed maps which laid the foundations of this general map were published by Sengör et al (1985),, Şaroğlu et al. (1987), Barka (1992) and Armijo et al (1992) (Figure.1).

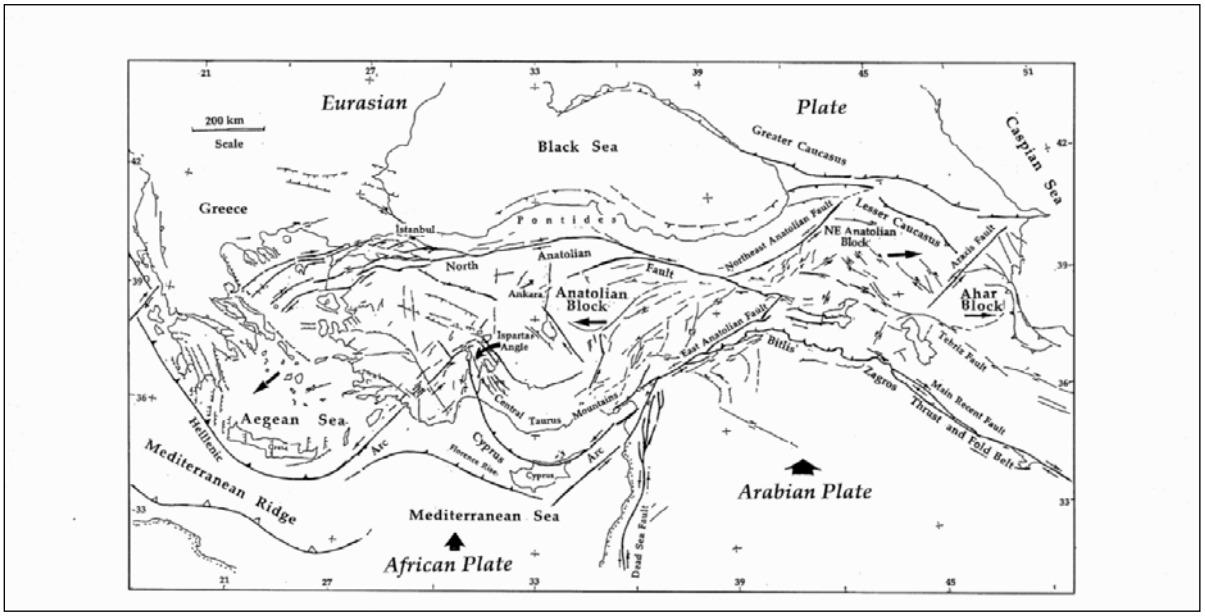

Figure 1. All of Turkey's major seismic potential high active faults and fold belts (Barka and Reilinger, 1997)

The faults (Figure.2) which will cause earthquakes in Izmir and its immediate vicinity have been shown on the maps drawn by researchers, public institutions and private institutions that have been conducting research in the city for many years. However, what should be kept in mind is the fact that no matter what kind of method is

applied, neither the exact location of the faults nor their earthquake-generating potentials can be precisely known. At this stage, it is especially important for scientists to regard the data-based predictions as accurate as possible.

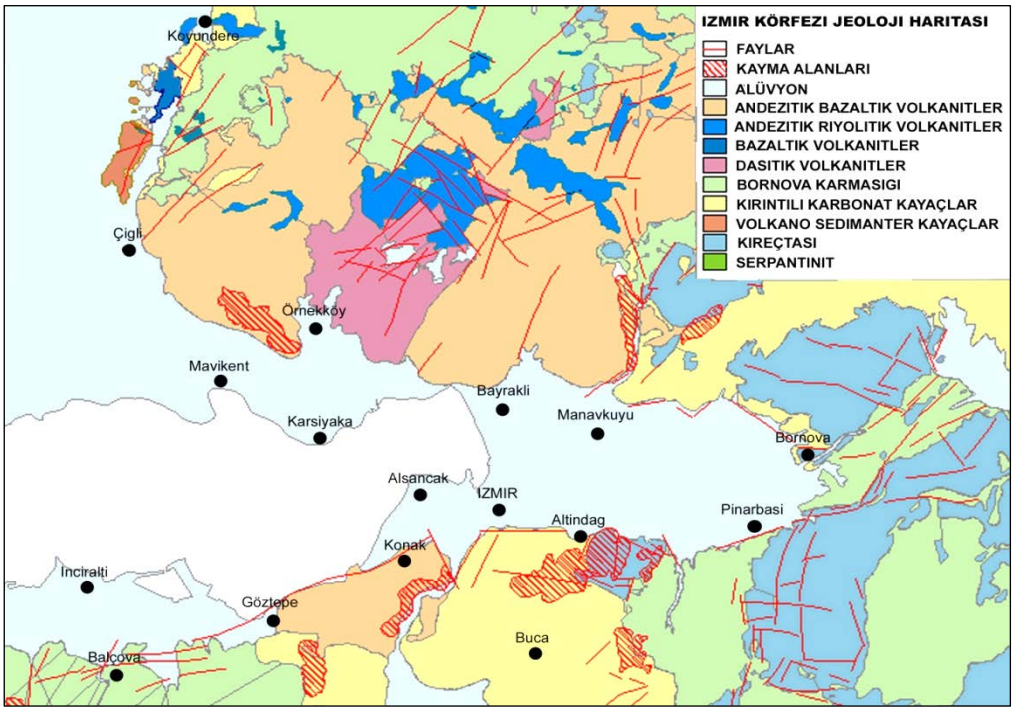

Figure 2. Geological map of Izmir and its immediate vicinity (MRE, 2005, compiled and modified from Tan et al, 2012.)

Constituting the second part of the study, the data on the conditions of the Buildings were compiled from the archives of the Chamber of Civil Engineers, and from the personal information and years of experience of the civil engineers who made presentations in the awareness-raising activities as specialists in their field. Thanks to this data, which is the most striking part of the study, many facts on the existing conditions of the buildings in Izmir have been brought to light (Figure 3) and the relevant institutions have been informed about the situation.

Figure 3. A 5-storey building without a foundation in Şemikler, İzmir (left), an illegal apartment built with the removal of the roof in Çınarlı (right) (Photos; Anonymous, 2009)

A written, visual and applied data set prepared by the Directorate of Izmir Provincial Civil Defense was used in the third part of the presentations within the context of "What Should We Do before, during and after an Earthquake?" Being very critical and aiming to prepare people for possible earthquakes, this part of the study

started with some video footage from the earthquake that occurred on August 17, 1999 and then lectures were given to inform people on what to do to avoid the recurrence of such situations in the future. The data set prepared and presented by Civil Defense experts contained information with visual materials from various quarters such as a family earthquake plan, reduction of non-structural hazards, earthquake safety at school (Figure 4), safe driving during an earthquake and even what to do if trapped under debris during or after an earthquake.

Figure 4. What should we do if we are at school during an earthquake? (Never go under the wooden desks!)

In the light of what has been explained so far, the last part of the study tackled the question “What will survivors need?" after an earthquake. The data used for this purpose were collected by experienced psychiatrists and psychological counselors who carried out conversation and sharing sessions with people for post-earthquake normalization of life. This part, which is especially very important for the success of this study, is also a sine qua non for the well-being of people who go through tragic events such as an earthquake because human beings tend to live in their emotions and some of the people will try to restore their lives after experiencing an earthquake disaster. People who will have lost their loved ones and possessions in an earthquake, in short, those who will have concerns about the future will need psychosocial support to be able to continue their normal lives again. Psychological first-aid services may not be sufficient at this point. However, proven-effective psychosocial support models which can be applied to people affected by earthquakes and many other similar disasters have just begun to be prepared in Turkey (Figure 5).

Figure 5. Continuing education in a kindergarten tent established after August 17, 1999 earthquake in Golcuk. (Some of the children in the photo have lost their parents in the earthquake. We remember them with sorrow...)

Findings of the Study and an Applicable Model

Having been addressed in a section of the first part of the study, the earthquake reality in Turkey was reemphasized using both historical and recent data. However, there is no denying the fact that it does not seem possible in the near future to predict the location, size and time of an "earthquake" at a reliable level. For this reason, the recent data on earthquakes which occurred and are expected to occur on the known fault lines enable us to make a prediction. The historical and instrumental earthquake records indicate that there have been many earthquakes in Izmir and its immediate vicinity in the past two thousand years. The presence of many active faults in the immediate vicinity makes it difficult to establish a direct relationship between earthquakes and faults (MRE, 2005, Report No: 10754). In order for this relationship to be meaningful and for earthquakes to be predicted, auxiliary data from other disciplines should be processed and included in the interpretation. One of the

auxiliary data is the soil conditions of an earthquake area. Despite lacking suitable soil conditions for high-rise buildings, the majority of Izmir consists of areas with high settlement density and extremely young and loose alluvial soils (Figure 2). A soil, regardless of the magnitude of an earthquake, makes its movement in the range of its own characteristics and can cause the structures on it to remain intact or to collapse.

The second part of the study revealed the situation of the buildings built on these soils. The scenario which is valid in all of Turkey is the same for Izmir as well. The situation of the buildings in Izmir and its immediate vicinity becomes evident with the data on soil investigation reports and proper location of water and electrical installations in an apartment shared by the specialist engineers, who also shared their knowledge with everyone openly on what we should pay attention to when buying an apartment and especially what our legal rights are.

The findings of the third part of the study demonstrated especially the extraordinary experiences of the search and rescue teams in the earthquakes that occurred in our country and also presented similar examples from different countries and the approaches they adopt and the actions they take in the face of earthquakes. The wide range of information regarding pre- and post-earthquake precautions shared and discussed at this stage included reduction of non-structural hazards and a family earthquake plan before an earthquake, the first aid to be applied to the wounded after an earthquake in Izmir, prevention of possible fire hazards and even the establishment of "Community Disaster Volunteers (CDV)" teams consisting of volunteers by raising the level of consciousness.

The final stage is perhaps the longest and the most comprehensive stage in terms of the scope of the data available since, at this stage, earthquake survivors need first spiritual and then financial support in order to continue their lives. It is especially very difficult to rehabilitate people who lose their mental health after an earthquake and it takes a very long time for people who lose their loved ones in an earthquake to recover. In fact, some people suffer from a loss of joy or a loss of interest in life and some prefer to end their lives as a result of psychological problems. This is one of the saddest truths of our country and unfortunately the majority of the society has been insensitive to it. Extreme feelings we had about and right/wrong reactions we showed towards not only the earthquakes but also the mine accidents in recent years have led to an inevitable situation. Specialist psychiatrists and social support workers exert themselves to the utmost just like they did in the Soma mine accident which took place on May 13, 2014. However, all this effort may be inadequate. For this reason, it is of vital importance to interpret the findings correctly and choose the most suitable model.

Suggested by Berkowitz (2010) and based on the transfer of a series of post-disaster coping skills which psychological counselors can apply in the long term after an earthquake, the "Skills for Psychological Recovery" model was brought up for discussion in the study. This model is an evidence-based modal approach which can be used in situations where psychological first-aid support is not sufficient in the period following traumatic events experienced by children, adolescents and adults. This model is not a mental health treatment but rather a secondary prevention model. In other words, it was designed to reduce stress, describe existing intervention skills and improve operability.

The main goals of this model can be listed as follows;

* Quick recuperation and recovery

* Preventing mental problems

* Supporting work

* Preventing behavioral disorders

In order to achieve these goals, it is imperative that all actors (authorized bodies of the state, engineers, doctors, workers, homeowners, tenants and even foreign experts if needed) fulfill their tasks duly. A defect in one of these integral parts will, otherwise, affect the whole "BUILDING."

Results and Discussion

Due to the bitter experiences caused by the earthquakes throughout history, people have to accept natural disasters as a normal part of life and learn to live with them. Due to its geological structure and location, there have been and will be many devastating earthquakes in Turkey, which is on one of the most important seismic

belts in the world. Material and moral damage incurred by an earthquake can be minimized by effectively implementing planned and rational tasks (Radius project, www.izmir.bel.tr/izmirdeprem/chp1.html). Since we will always encounter natural and man-made disasters, these and similar models should be examined and adaptations should be made considering the existing conditions. This model should be examined in more detail by relevant experts together with the contributions of other disciplines and put into practice.

The model suggested by this study is actually only to help solve the problem. Earthquake scenarios can be described by a number of models, however, it takes a lot of time and effort to describe and implement a psychosocial model that will be set after an earthquake. This model, which is to be implemented to bind up the wounds of the suffering especially after major disasters such as an earthquake, should be adapted and improved further considering all living conditions in our country.

In conclusion, it should be kept in mind that the principle of "Human life comes first." should penetrate all levels of the society and all aspects of social life, and as Mustafa Kemal Atatürk stated "it is of vital importance to think about measures to prevent and be protected from a catastrophe before it actually happens."

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AN EMPIRICAL INVESTIGATION OF GREEN PURCHASING AND ENVIRONMENTALLY FRIENDLY BEHAVIOUR

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Abstract: The worldwide environment consciousness has increased in healthcare sector while globalization has led to major trend of medical products all over the world. Due to an increasing recognition in environmental impact, hospitals are more precision towards when their purchasing decisions making. The propose of this paper is to demonstrate the importance of green purchasing practices and analyze the effect of environmentally friendly behaviors of healthcare personnel on the purchase process of the public hospital. This study have intended to understand the healthcare personnel behavior to purchase green products in context of a developing country; Turkey. Data were collected from survey of healthcare enterprise in Istanbul and analyzed using SPSS 22. A usable responses were collected with the help of a questionnaire survey using the convenience sampling approach. The analysis result confirms that the ecological awareness of healthcare personnel are significant in determining their hospital's purchase. The results show that green purchase behavior was significantly related with environmentally friendly behavior in public hospital. The research findings provide useful insights for healthcare sectors in Turkey to adopt green purchasing practices.

Keywords: Environmentally Friendly Behavior, Green Purchasing, Hospital.

Introduction

Today the environmental issue has become an important issue among hospitals as well as consumers. The environmental concern has led to an increase in consumers' demand for environmentally friendly products. Hospitals have responded by introducing a variety of green initiatives such as green medical products and equipment. They can develop sustainable marketing strategies targeting these consumers (Kanchanapibul et al. 2013). It is clear that the ways in which consumers choose goods and services have both direct and indirect effects on the environment (Lai and Cheng, 2015). The promotion of environmentally friendly and green purchase behavior is one of the ways to minimize the environmental impact.

The concept of green purchasing is gaining increasing attention among academicians as well as practitioners. The increasing attention towards protection of the natural environment and environmental issue has changed the consumer purchasing preferences (Yadav et al. 2017). The green purchasing has expanded rapidly in the developed nations, but with time this concept is also getting its foothold in the developing nations such as Turkey. The present research has used the theory of planned behavior framework to understand the consumers' behavior towards purchasing green products in the different sectors. In the purpose of this study to evaluate a relationship between the healthcare personnel behavior and purchase green products in Turkey. The analysis findings supported that the ecological awareness of healthcare personnel are substantial in the determination of hospital's purchasing decisions. The results show that there are a positive correlation between green purchase behavior and environmentally friendly behavior in public hospital.

The rest of this paper is organized as follows. Section 2 reviews more relevant literature. Section 3 includes research design, data collection and hypotheses are developed. Also, data analysis is presented including validity and reliability test and hypotheses testing. Section 4 discusses the analysis result and green purchasing implementation in hospital. Finally, we draw conclusions and highlight possible future work in section 5.

Literature Reviews

Purchasing of environmentally friendly products and avoiding of purchasing products, which are harmful to environment, calls green purchasing (Chan, 2001). Consumers' green purchase behavior and their willingness to purchase green products, which is called intention, are the most often indicators of the green purchasing measurement.

In recent times, environmental consciousness has been increased dramatically across to the world. Because of the social and territorial problems as well as consciousness of consumers, the importance of ecology and natural balance has been discussed from the 1980s to the day-to-day process. In our changing world where technology is rapidly developing, modern companies should keep up with approaches to conservation of the environment. Worcester (1993) determined that the pollution and other environmental damage are impacted on their daily life according to 69 percent of the general public. He demonstrated his survey that the public was demanding action by companies and by governments on environmental issues. Another study recommends than consumer awareness of environmental troubles has been growing rapidly in this decade (Cartel et al., 2000).

According to a survey, which held among USA university students, environmental sensitivity vary with age, so, younger people are more sensitive to the environment than the elderly ones. Further results states that women are more interested in environmental issues, education level is positively related to environmental attitudes and behaviors, and people living in cities have more environmental concerns than living in rural areas (Straughan et al., 1999). So organizations not only have to produce more services and contribute to economic development but also have to pay attention to their services and products into conformity with environment. Consumers are closely interested in both purchasing and consuming environmentally friendly goods, furthermore, details of the production process using scarce resources and the waste assessment become an important indicator. As long as the consumers' sensitivity to environmental issues grows, companies' starts to initiate environmental friendly programs, which is called "proactive environmental programs", these programs mainly focus on developing reusable products, conserving energy, reducing and recycling wastes, developing environment first orientation on their corporate culture and codes so on (Handfield et al., 1997; Min et al., 2001). Environmental sensitive management enhanced financial performances of enterprises and values of shares outstanding (Klassen et al., 1996). Due to consumers' this environmental sensitive behaviors, businesses which discharge the duties and responsibilities, and sustaining practices that better protect on nature will be able to survive in the future.

Green logistics is also to be organized sensitively to the environment activities of supplier, distributors and customer. Green logistics involves four main functions such as green purchasing, green product and materials management, green distribution and marketing and lastly reverse logistics. Waste management, such as reducing and recycling of the production related wastes and reclamation of recycled wastes, is also an important part of the green purchase decision making (Min et al., 2001; Sarkis, 2003). Green purchasing refers to manufacturing, buying, packaging, distributing, reusing or disposing an environmentally preferable raw material, product or service. It also means buying a service or product which affects human health or the environment less or poses lower risk compared to its competitor which is used for the same function or purpose (Clinton, 1998).

Over the last decades to explain consumer's environmental purchasing behavior, there are various new articles about green purchasing and related subjects such as green production, green acquirement so on in the literature. Green supplies construction and impacts become a popular subject among researchers, and their journals have been published on several high profile journals such as, journal of purchasing and supply management, transportation research and other journals. Most of them analyzed the correlation between the consumer or personnel behavior and purchasing green products in different markets. Schlegelmilch et al. (1996) assessed the strength of relationship between the measures environmental consciousness and pro-environmental purchase behavior. They stated that attitudes were the most important predictor of pro-environmental purchase behavior. There had been relatively small approaches to classify consumers especially their levels of green purchasing behavior. Follows and Jobber (2000) have tested a consumer model using covariance structural analysis for environmentally responsible purchase behavior and values that are fundamental to explain attitude formation. Individual consequences, taking the personal implications of consumption into account, had been found to be just as important in predicting intention as the environmental consequences of a product. Companies green purchasing effects their performances. Furthermore, green purchasing not only, effects firms net income, but also, effects the cost of sold goods as long as, the firm has been controlling its size, leverage so on (Carter et al., 2000). It was determined the influence of consumers' environmental sensitivity on product choices in another study (Seitz et al., 2001). They found the behavioral factors played a major role in purchasing environmentally sensitive packaged products.

A survey has been held on US firms, which have greater environmental risks. That survey presents empirical results to purchasing department professionals about environmental friendly oriented purchasing strategies, in order to reduce their risks (Min et al, 2001). Empirical results mainly oriented to practicing green purchasing, green purchasing's effects on supply chains, waste management and regulation compliance. In addition, a structural equation model for ecological consumption orientation has been modelled by using previous green purchase orientation (Kim et al, 2005). According to the model, believing about consumer effectiveness vary on social value orientation. As a result of that, social value orientation influence green purchasing orientation. Another survey has been held on young consumers' of Hong Kong, in order to figure out their green purchase behavior. According the Hong Kong survey; young peoples' main aim for green purchasing is social influence which is followed by, environmental concern, self-image in environmental production and sensed environmental responsibility (Lee, 2008). Green supply adoption has five parameters such as, effectiveness, purchase pricing, organizational concerns, health-safety and other partners (Salam, 2008).

A structural model states the relation between environmental performance and the purchasing performance. According to the model, environmental performance has a positive impact on purchasing performance, moreover, green performance vary on both green supply assessment degree and applying level of green collaboration (Large et al, 2011). Young generations' green purchasing behavior's in the context of the influence of ecological affect and ecological knowledge has been examined, and empirical results showed that both the ecological affect and ecological knowledge were very significant on their green involvement and purchasing orientation (Kanchanapibul et al, 2013).

Dubey et al. (2013) argued that green purchasing behavior positively affects the customer satisfaction and market share in manufacturing companies of India. They analyzed their article the theoretical framework and obtained the result that there was a positive correlation between the market pressure, leadership, regulatory framework and quality management. Joshi and Rahman (2015) reviewed 53 empirical articles related to attitude - behavior inconsistencies in the context of green purchasing on green purchase behavior from 2000 to 2014. They have put forward two main reasons that affect consumers' green purchasing behavior; Consumer's environmental concern and functional attributes of the products. Yadav and Pathak (2016) analyzed the consumers' environmental purchasing behavior markers using the theory of planned behavior in emerging markets. The findings described that TPB fully supported the consumers' intention to buy green products which in turn influences their green purchase behavior. In contrast to the others, Schlossberg (1991) and Winski (1991) have argued that there is a weak correlation between consumers' behavior on environmental issues and converting these behaviors into real purchasing behavior.

Liobikien et al. (2017) states the differences between green purchase and their determinants, with subject to, Lithuanian and Austrian data sets. That study recommends that Lithuanian data sources requires to encourage for green purchasing, for practicing environment friendly behavior. The green purchasing intention of the consumers are significantly affected by environmental behaviours and eco-label and cultural values (Chekima et al, 2016). Furthermore, packaging and advertising strategies of the products are the main factors of the consumers' purchasing orientation. As a result of that, packaging and advertising should emphasize individuals' positive effects on particular environmental issues and their green purchase orientation (Lai et al, 2015).

Research Design and Data Collection

In this paper, questionnaire survey has been used to comprehend the green purchasing in healthcare sector. Sample was taken from the public hospital in İstanbul. The survey was executed from January to May 2017. Questionnaire is asked to selected healthcare personnel such as doctors, nurse, and administrative staff in hospital. They are in best position to give opinion on the strategic aspects related to green purchasing in healthcare sector in Istanbul. The questionnaire is devised as "five point Likert scale". Besides, face to face survey method is implemented for administration of the questionnaire. For the purpose of carrying out statistical analysis individual responses are conducted from 1 through 5 accordingly. Furthermore, questions asked to respondents regarding environmentally friendly behaviors related with green purchasing by using 5 point Likert scale.

Collected data are collated both in SPSS 22 and analyses by using an exploratory factor analysis. We employed the principal components analysis with varimax rotation. This contributes to determine the presence of meaningful patterns between the original variables and extract the major factors. Principal component analysis with varimax rotation is employed in order to clarify the dimensions of environmentally friendly behaviors and green purchasing in hospital. Some variables are allocated as an effect of the demographic findings. Since the objective of the questionnaire was to collect the healthcare's personal attitudes, six demographic variables were investigated, namely, gender, age, level of education, income, jobs and operation time of job.

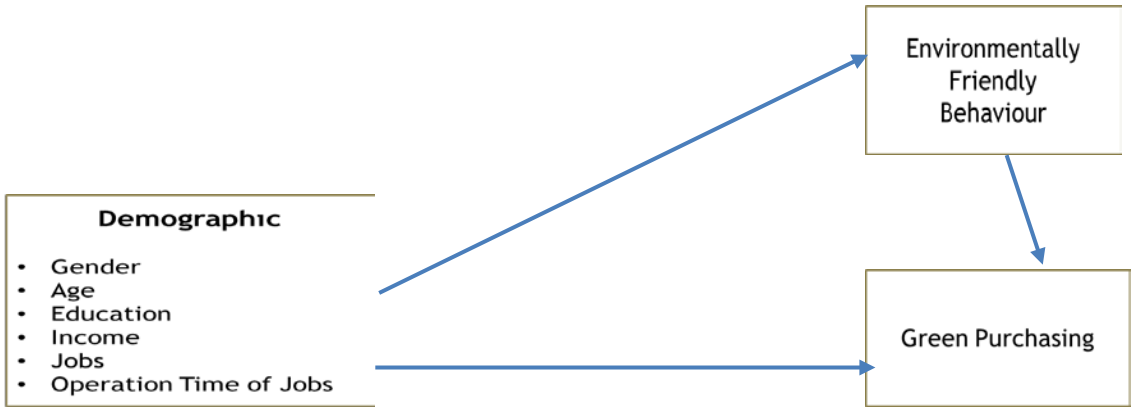

Figure 1: Research Model

Results and Discussion

The profile of respondents includes gender, age, education, income, jobs, and operation time of jobs. The gender has minimal next to less than eleven percent difference; 44.7% male and 55.3% female. The respondents' age is mostly between 20 -30 years old (22.4%), 31-40 years old (24.7%), 41-50 years old (27.1%), 51-60 years old (25.9). Regarding educational attainment; 11.8% graduated a high school, 18.8% graduated a vocational school and 40% had a bachelor degree, 29.4 % had a master degree. In this study, all of the participants are healthcare personnel, moreover, majority of the participants have bachelor degree from different universities and institutes.

In terms of jobs, 38.8% of respondents are nurse, 26.1 % of respondents are doctor, and 34.1% are administrative staff. Healthcare personnel major payment scale lies either in 1500-2000 or 2501-3500 intervals. Furthermore, 38.8% of the participants have been working more than 11 years, as a result of that, employees works long periods in this public hospital.

Table 1: Preliminary characteristics

Measure	Value	Frequency	Percent
Gender	Female	47	55,3
	Male	38	44,7
Age	20-30	19	22,4
	31-40	21	24,7
	41-50	23	27,1
	51-60	22	25,9
Education	High School	10	11,8
	Vocational school	16	18,8
	University	35	40
	Master	25	29,4
Income	1500-2500	18	21,2
	2501-3500	20	23,5
	3501-4500	16	18,8
	4501-5500	10	11,8
	5501-6000	9	10,6
	6000 and over	12	14,1
Jobs	Nurse	33	38,8
	Doctor	23	26,1
	Administrative staff	29	34,1

Operation time of job	Less than 1 year	12	14,1
	1-2 years	9	10,6
	3-5 years	17	20
	6-10 years	14	16,5
	11- 15 years	17	20
	16 and over	16	18,8

For green purchasing implementation, wherever applicable, Cronbach's coefficient (Alpha) is calculated. It is used to calculate internal consistency of responses and reliability in this survey. Here, statistical tests are conducted to prove the reliability and validity of the items measured. First, a Cronbach's alpha test was performed on all the constructs to assess the reliability of the collected data. Items are mainly considered to be valid if their alpha factor exceeds a level of 0.70. The Cronbach's alpha coefficient of this study is 0,812. On this scale, they are determined to have a high reliability.

Table 2: Descriptive statistics

	N	Mean	Std. Error of Mean	Std. Deviation
Environmentally friendly behaviors	100	4,2094	0,6226	0,57396
Green purchasing	100	3,5588	0,9943	0,91674

Table 2 provides a brief summary of the responses. The mean and standard deviations are calculated to explain the current situation for environmentally friendly behaviors and green purchasing. The means show in Table 2 are in range 3,55 – 4,20. It points out that public hospital in Istanbul have already implemented actions to integrate green purchasing implementation. The standard error mean describe in range 0,62 - 0,99 and standard deviations define in range 0,57 – 0,91.

Table 3: Green Purchasing Frequency

Green Purchasing		**1**	**2**	**3**	**4**	**5**	**Total**
It is considered how this product will affect both the patient and the hospital when purchasing a product	Frequency	1	4	16	26	38	85
	Percent	%1,2	%4,7	%18,8	%30,6	%44,7	%100
Our hospital is purchasing reusable products.	Frequency	5	14	30	22	14	85
	Percent	%5,9	%16,5	%35,3	%25,9	%16,5	%100
Our hospital chooses to purchase products that are not over-packed.	Frequency	4	17	17	30	17	85
	Percent	%4,7	%20	%20	%35,3	%20	%100
Our hospital checks the signs and symbols on the environment when purchasing products to see if they are environmentally friendly.	Frequency	7	13	12	18	35	85
	Percent	%8,2	%15,3	%14,1	%21,2	%41,2	%100

Our hospital is cooperation with suppliers who are ISO 14001 certified.	Frequency	8	11	28	18	20	85
	Percent	%9,4	%12,9	%32,9	%21,2	%23,5	%100
Our hospital chooses suppliers by setting environmental criteria in the procurement process.	Frequency	4	19	21	23	18	85
	Percent	%4,7	%22,4	%24,7	%27,1	%21,2	%100

According Table 3, some questions which are "our hospital is purchasing reusable products" and "our hospital is cooperation with suppliers who are ISO 14001 certified", explain that unstable rates are so high. Healthcare personnel support that hospital is considered how this product will affect both the patient and the hospital when purchasing.

Table 4: Correlation between environmentally friendly behaviors and green purchasing

Green Purchasing	r	p
G1:It is considered how this product will affect both the patient and the hospital when purchasing a product	0,473**	0,0005
G2:Our hospital is purchasing reusable products.	0,555**	0,0005
G3:Our hospital chooses to purchase products that are not over-packed.	0,219*	0,44
G4:Our hospital checks the signs and symbols on the environment when purchasing products to see if they are environmentally friendly.	0,431**	0,0005
G5:Our hospital is cooperation with suppliers who are ISO 14001 certified.	0,89	0,42
G6:Our hospital chooses suppliers by setting environmental criteria in the procurement process.	0,191	0,80

**. Correlation is significant at the 0.01 level (2-tailed).
*.Correlation is significant at the 0.05 level (2-tailed).

Table 4 has been examined whether there is a relationship between environmentally friendly behaviors and green purchasing in public hospital. In the correlation analysis, we found that G1-G2-G4 have a significant positive impact. Furthermore, Correlation coefficient (r) appear to be significant at the 0.01 and 0,05 level and in the same direction of the relationship. In this context, thirteen hypotheses in Table 5 below has been provided and has been analyzed by using different analysis methods. T test and Anova analysis has been carried out to find out, whether there is any statistical difference between demographical characteristics and environmental friendly behavior of the survey participants. The accepted hypothesize states that, there is a statistically meaningful difference between demographical characteristics and environmental friendly behavior with respect to income, occupation, operation time of occupation variables. On the other hand, this hypothesis has been rejected based on gender, age and education variables. Furthermore, survey participants' demographical characteristics against green purchasing orientation has been examined as well. As a result of the analysis, there is a statistically meaningful difference between income, occupation and green purchasing variables. Correlation analysis shows that there is a relation between environmental friendly behavior and green purchasing

Table 5: Results of Hypotheses

Hypotheses		Results
H1	Gender - The environmentally friendly behavior	Not supported
H2	Age - The environmentally friendly behavior	Not supported
H3	Education - The environmentally friendly behavior	Not Supported
H4	Income - The environmentally friendly behavior	Supported
H5	Jobs - The environmentally friendly behavior	Supported
H6	Operation Time - The environmentally friendly behavior	Not supported
H7	Gender - Green purchasing	Not supported
H8	Age - Green purchasing	Not supported
H9	Education - Green purchasing	Supported
H10	Income - Green purchasing	Supported
H11	Jobs - Green purchasing	Supported
H12	Operation time - Green purchasing	Not supported
H13	The environmentally friendly behavior - Green purchasing	Supported

Conclusion

Growing consumer awareness of the environmental and social impacts associated with product consumption facilitates penetration. The statistical analysis confirmed that environmentally friendly behavior of healthcare personnel have a significant impact on green purchasing. Our results also showed that they have a higher degree of theoretical knowledge of ecology. However, all the respondents point out strong bond with ecological study were likely to be deeply involved in green purchasing. The study explains that personal affective response is a key motivation to actually become involved in green purchasing.

The objective of this paper was to analyze how green purchase is related to environmentally friendly behavior in public hospitals. It is very important to promote the environmental awareness particularly in Turkey. The high correlation with significant reliability is evidence to support the verification of the hypothesis. This highlights the importance of creating favorable conditions in terms of availability which may facilitate and ease hospital's decision of buying of green products. Healthcare personnel encourage that hospital is decided how this product will affect both the patient and the hospital when purchasing medical equipment. In the purpose of this study to evaluate a relationship between the healthcare personnel behavior and purchase green products in Turkey. The analysis findings supported that the ecological awareness of healthcare personnel are substantial in the determination of hospital’s purchasing decisions. The results show that there are positive correlation between green purchase behavior and environmentally friendly behavior in public hospital.

In addition, the findings revealed that income and jobs have a significant positive effect in the environmentally friendly behavior. Results point out that education, income, jobs have a significant positive effect in the green purchasing. It is imperative that businesses adopt environmental implementation. In order to maintain the consumer society, hospitals need to focus on delivering satisfaction. As long as the environmental ideology is dominant, the green purchasing will be prosperous with a greater number of consumers. Future research might be conducted by extending the research into general environmental attitudes and green purchasing, which may be indicated by comparing public, university and private hospitals

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ANTIMICROBIAL PROPERTIES of WOOD WATER OBTAINED by A HIGH FREQUENCY VACUUM DRYING METHOD

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Abstract: The objective of this study was to determine the antimicrobial activity properties of the wood water released from specimens during the drying process. The specimens were dried using a high-frequency vacuum (HfV) drying method. Wood specimens from white oak (*Quercus alba* L.), walnut (*Juglans regia* L.), and Eastern beech (*Fagus orientalis* L.) were dried inside a drying kiln with settings of 7.56 MHz frequency, 39.19λ wavelength, and 0.5 to 0.97 mBar vacuum. The moisture content (%) of the white oak, walnut, and Eastern beech specimens prior to kiln drying were 70% to 75%, 80% to 90% and 75% to 80%. Drying days of wood specimens were 16, 10, and 8, respectively. The antibacterial and antifungal activities of the wood water samples were determined using the microdilution method. According to the antimicrobial test results, the best antimicrobial properties were found in the white oak's drying water, with only 6.3 mg/mL of K. *pneumoniae* bacteria.

Keywords: Antibacterial activity; antifungal activity; wood water; high-frequency vacuum (HfV) drying

Introduction

Drying is the process to reduce water of wood to make wood material ready for lots of areas of usage. And, also drying is important for potential use of obtained water while drying process (Altınok et al. 2009). Drying methods are classified into two; natural and technical. In the past, wood materials were dried naturally using the sun's radiation and air flow; however, technical methods of drying are currently employed. Technical drying includes many different methods, which have come about through the advances in technology. The most common industrial drying methods for solid wood materials are classical, condensation, and vacuum drying. In addition, high-temperature, high-frequency, and microwave drying methods are less commonly applied. The first industrial radio-frequency vacuum (RfV) driers were developed by the Russian Academy of Sciences in the 1960s. High-frequency vacuum (HfV) driers were developed by Koppelman in the USA in 1967 (Resch, 2006). Currently, the HfV combined drying method prevails because of its many advantages in comparison with classical drying methods. Classical drying methods are insufficient for drying thick lumber without any deformation and also take longer without achieving the desired quality level (Güler et al. 2012).

Wood properties, such as combustibility, color, density, smell, feel/sense, compressive strength resistance, and dehumidifying capability, vary depending on the amount of extractives present in the material (Tutuş et al. 2010). Wood extractives evaporate while drying process because there is an open drying system either natural or technical drying is used. However, HfV is a completely closed drying system that does not require a chimney or additional humidifying equipment. Therefore, the water released from the drying process is generally purer because there is not any mixture. Therefore, utilization of obtained water which is rich in terms of extractives becomes meaningful (Güler et al. 2012). The released wood water can be further processed and utilized in cosmetic goods such as perfume and creams because of its pleasant aroma.

Turkey has an abundance of flora in terms of plant diversity. Turkey is located on the border of three phytogeographical regions and is a bridge between South Africa's and Southeast Asia's flora. In addition, species endemism is high in Turkey because Anatolia is the origin and differentiation center of many kinds and section. These can be assumed as some of the reasons of this abundance. There are approximately 9000 natural plant species and 30% of these are endemic, but still not enough benefited from the richness of this plant (Tan, 1992). Plants' antimicrobial activities and properties are important for human health and have been investigated since 1926 (Vonderbank, 1949; İlçim et al. 1998). According to the World Health Organization's research, the number of medicinal plants for therapeutic purpose is around 20,000 (Dığrak et al. 1999). Increased incidence of drug resistance which has become a global issue in recent years is reported because of the adaptations of certain bacteria species to antibiotic strains (Kalaycıoğlu and Öner, 1994). This problem has a great importance in developing

countries because of an excess in the number of reported infectious diseases (Abascal and Yarnell, 2002). This is why the use of medical plants as an alternative to synthetic medicine (e.g. penicillin) is recommended and plants are being introduced as antimicrobials (Solanki, 2010). Currently, medical plants are utilized because they exhibit less adverse effects and microbial resistance than synthetic medicines that are already in use. However, medical plants may provide a slower recovery rate (Seyyednejad and Motamedi, 2010). Results of some research studies show that the antimicrobial agents obtained from natural resources, i.e., plants, highly succeed in protection of food safety (Alzoreky and Nakahara, 2003). According to the literature, antimicrobial activity occurs in the presence of secondary metabolites inside of a plant, such as alkaloids, flavonoids, tannins, and terpenoids. Secondary metabolites which are not directly related to the basic vital function of the plant are produced in woody plants. Furthermore, these secondary metabolites consist of herbivores and pathogens to provide protection from abiotic surrounding stresses, e.g., UV radiation (Toroğlu and Çenet, 2006). Secondary metabolites are a diverse group that includes many compounds. Phenolic compounds are extremely important because of their role in anti-carcinogenic and antimicrobial effects. Also, it is known that phenolic compounds exhibit a potent antioxidant effect by quenching free radical activity. Free radicals can cause damage to tissues and DNA by attacking the nucleic acids, somatic cells, and weakening the immune system (Zhao et al. 1999; Bouwmeester, 2003).

In light of this information, the aim of this study is to determine the antibacterial and antifungal properties of water obtained using the HfV drying method. And, also remark the utilization possibility of obtained water in different sectors.

Materials and Methods

Three tree species, i.e., white oak (*Quercus alba* L.), walnut (*Juglans regia* L.), and Eastern beech (*Fagus orientalis* L.), were used in this study. White oak was grown in small plantations on the stream beds and slopes in Thrace, Marmara, and Northwest Anatolia regions of Turkey. Oak logs were 15 to 21 cm thick, 30 cm wide, and 300 to 350 cm length and had 70% to 75% inlet moisture. Walnut logs were generally grown in the East Anatolia region of Turkey (Adıyaman, Muş, Bitlis, and Bingöl environments). Walnut logs were in the form of gunstock and rifle butt and had dimensions of 7 to 7.5 cm thick, 16 to 20 cm wide and 45 to 90 cm length, as well as 80% to 90% inlet moisture. Eastern beech logs had various dimensions and 75% to 80% inlet moisture.

In this study, following bacteria, yeast and fungi were used to investigate antimicrobial activity. *Staphylococcus aureus* (6538P), *Klebsiella pneumoniae* (CCM 2318), *Escherichia coli* (ATCC 11230), *Pseudomonas aeruginosa* (ATCC 27853), *Proteus vulgaris* (ATCC 6897), *Bacillus cereus* (CCM 99), *MRSA* (ATCC 33592), *Salmonella typhimurium* (ATCC 14028) were bacteria. *Candida albicans* (ATCC 10239) was yeast. *Aspergillus niger* van Tiegh (TA 47-3), *Aspergillus flavus* Link (TA 41-17), *Aspergillus ochraceus*, K. Wilh (MUCL 39534), and *Fusarium proliferatum* (Matsushima) Nirenberg (TA-18-2) were fungi.

This study was conducted in two stages. In the first stage, water released from the wood logs and collected in a barrel using the HfV drying method as shown in Fig. 1. A 25-m3 drying kiln (King Dryer, HF+V 5025, Düzce, Turkey,) was used for the drying processes, with the parameters of 7.65 MHz frequency, 39.19λ wavelength, and 0.5 to 0.97 mBar vacuum.

After the drying process, the moisture content (%) of the oak, walnut, and beech logs were between 8.0% and 15%, 8.0% and 15%, and 7.0% and 8.0%, respectively. The drying durations of the oak, walnut, and beech logs were 15 to 17 (avg. 16) days, 8 to 11 (avg. 10) days, and 7 to 9 (avg. 8) days, respectively. The obtained wood water was kept fresh (not ex-stock) and was protected from direct sunlight.

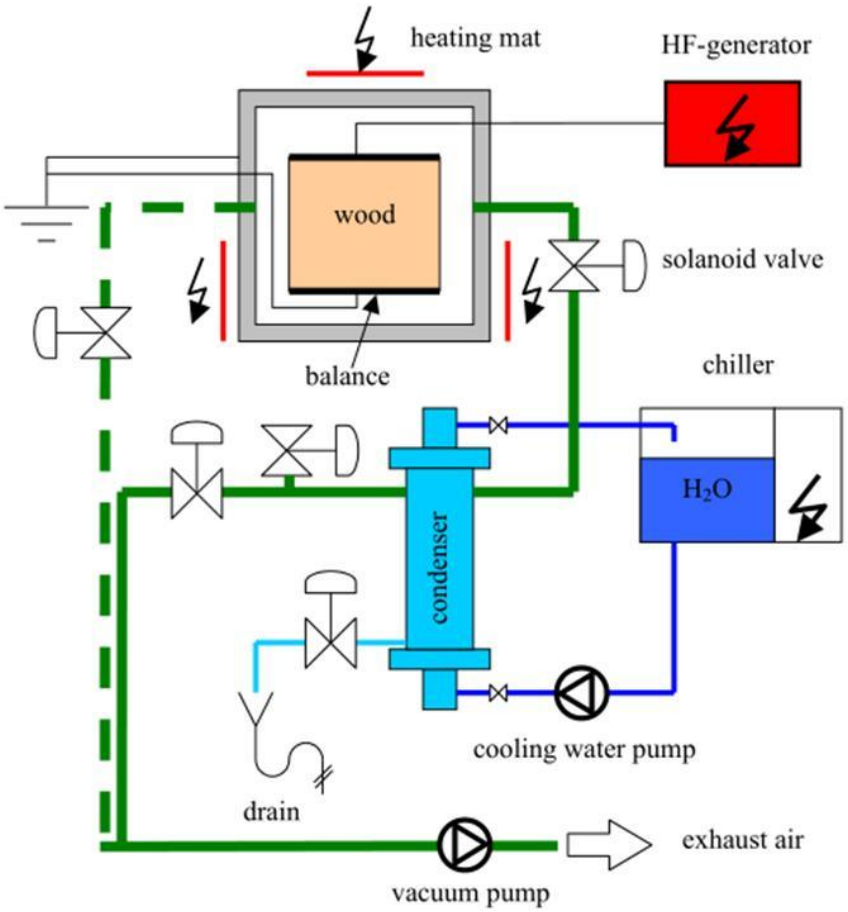

Figure 1: Schematic of the high-frequency current vacuum dryer (Korkut, 2011; Resch and Hansmann, 2002).

In the second stage of this study, the microdilution method was used to determine the antimicrobial activity. Bacteria suspensions were prepared according to the normal saline and MacFarland 0.5 standards for antibacterial activity. Also, trueness of the measurements was confirmed at a 0.5 absorbance value read from the spectrophotometer's indicator at 600 nm. Fungus inoculum activity was adjusted at a 0.5 absorbance value read at 450 nm. Bacteria and fungus were subjected to incubation on nutrient agar slant at 37°C for 24 h and Malt agar slant at 28°C for 72 to 96 h, respectively. Inoculum suspensions were prepared with fresh cultures and studied in three series on well-plates for each microorganism. Sabouraud Dekstroz Broth (Oxoid Ltd., Hampshire, England) and Nutrient Broth (Merck KGaA., Darmstadt, Germany) were used as the medium for the fungus and bacteria, respectively. At first, 100 µL of medium was pipetted into all wells, expect the first one. And after, 150 µL of medium and 50 µL of extract were pipetted into the first well and dilutions were serially made by taking 100 µL of the extract solution out from the previous wells (from 2nd to the 11th well). The final extraction concentration in the wells was prepared between 0.05 mg/mL and 25 mg/mL when the dilution processes were completed. Exactly 20 µL of inoculum suspension was grafted into all wells after the dilution process except negative control. All of the microplates were incubated at 37 °C for 24 to 48 h for bacteria and 28 °C for 72 h for fungi. After the incubation period, concentration which had higher value and was prior to the growth realized concentration was recorded as the minimum inhibitory concentration (MIC) values (CLSI, 1997; Walsh, 2008). The MIC values were expressed as the static activity of microorganisms, or in other words, expressed as the concentration value where the growth of microorganisms is inhibited. However, the bactericidal and fungicidal terms express the concentration value which kills the microorganism. In this method, 20 µL was extracted from each well plates' wells (no growth ones) and then cultivated by applying to petri plates of Sabouraud Dekstroz Agar for fungus and Nutrient Agar for bacteria.

The values of growth unrealized concentrations denoted the minimum bactericidal concentration (MBC) for bacteria and the minimum fungicidal concentration (MFC) for fungus after the incubation process under the above-stated conditions (CLSI, 1997).

Results and Discussion

MIC values which inhibit the growth of the microorganism and MBC and MFC values which represent the values of bactericidal and fungicidal activity were presented in Table 1.

Table 1: MIC and MBC/MFC Values (mg/mL) of Wood Water Samples.

Microorganisms	Oak (*Quercus alba* L.)		Beech (*Fagus orientalis* L.)		Walnut (Juglans regia L.)	
	MIC	MBC	MIC	MBC	MIC	MBC
P. aureginosa	6.3	12.5	12.5	12.5	12.5	25
S. aureus	6.3	12.5	12.5	12.5	6.3	12.5
K. pneumoniae	1.6	6.3	6.3	12.5	12.5	>25
P. vulgaris	12.5	>25	12.5	>25	12.5	>25
B. cereus	12.5	>25	12.5	25	25	>25
E. coli	25	25	12.5	>25	25	>25
MRSA*	12.5	25	12.5	>25	12.5	25
S. typhimurium	6.3	>25	25	>25	25	25
C. albicans	12.5	25	25	>25	12.5	25
A. flavus	6.3	12.5	25	>25	25	>25
A. niger	12.5	>25	25	>25	25	>25
A. ochraceus	12.5	>25	12.5	>25	12.5	25
F. proliferatum	12.5	>25	25	>25	12.5	25

**Methicillin-resistant Staphylococcus aureus, MIC-minimum inhibitory concentration, MBC-minimum bactericidal concentration, MFC- minimum fungicidal concentration*

The best antimicrobial activity was observed in oak (*Quercus alba* L.) wood water with *K. pneumoniae*. It was observed that the oak wood water had no MBC activity with *P. vulgaris, B. cereus, S. typhimurium, A. niger, A. ochraceus, and F. proliferatum*, although MIC values were between 6.3 and 12.5 mg/mL (MBC > 25). The MBC values remained between 12.5 and 25 mg/mL despite MIC values were 6.3 to 12.5 mg/mL as for against other bacteria.

The MBC value of beech wood water with *P. aureginosa, S. Aureus, K. pneumoniae*, and *B. cereus* remained between 12.5 and 25 mg/mL despite MIC values between 6.3 to 12.5 mg/mL. The MBC activity was observed in beech (*Fagus orientalis* L.) wood water samples with *P. vulgaris, E. coli, MRSA, S. typhimurium, C. albicans, A. niger, A. ochraceus, A. flavus*, and *F. proliferatum*.

The MBC activity against six of the bacteria strains was observed in walnut (*Juglans regia* L.) wood water; however, the MBC values were observed between 12.5 and 25 mg/mL for all others.

Conclusion

According to the results of this study, minimal MIC values were determined in oak wood water obtained from oak (*Quercus alba* L.) log against *K. pneumonia* bacteria. The wood water from oak and walnut exhibited antimicrobial activity on seven species of bacteria, while beech wood water exhibited antimicrobial activity on four species of bacteria.

The HfV technical drying method was used in this study. The HfV method required only 1.5 to 9 days for drying the samples (Güler et al. 2012). And, this causes an increase in obtained drying water due to short cycling.

Beside this, there are lots of advantages of HfV method. These can be summarized as follows; heating source for drying process is electricity which does not release toxic gas to the environment, provides opportunity to dry thick logs, capability of uniform and selective drying (less humid regions consume less power while much humid regions consume much power), provides energy efficiency between 40% to 50%, low operational costs such as operating, maintenance and repair, etc., lower temperature requirement avoids defect formation such as cracking, warping, fiber breakage and etc. thanks to vacuuming (Dığrak et al. 1999), stowing the batch inside a vacuum kiln without wood lath/slat means close packing or efficient use of kiln volume and cost effectiveness too.

Results obtained from this study show that wood water samples have antibacterial activity. Therefore, results from this study imply the necessity for the evaluation of wood water as a reusable and value-added commodity for the

plant-derived medicine industry in Turkey.

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BOHMIAN MECHANICS MADE MACHIAN

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Abstract: Non-relativistic shape dynamics is a Machian theory of particle interactions. It comes with three constraints to be satisfied if the Newtonian absolute space is to be used. On the other hand, Bohmian mechanics is a realistic interpretation of quantum mechanics. It is a type of non-local hidden variables theory. We supplemented Bohmian mechanics with appropriately calculated shape dynamics constraints to make it fully Machian.

Keywords: Bohmian mechanics, Mach's principle, Shape dynamics

Introduction

There are many versions of the Mach's Principle in the literature. Bondi and Samuel (1997) cite about ten versions of this principle. The version we consider is Julian Barbour's interpretation (Barbour, 2010). He states that in order for a theory to be Machian, a tangent vector or a direction in the reduced configuration (configuration space quotiented by the gauge groups) space should be able to determine the evolution of the system uniquely (Barbour, 2010).

Bohmian Mechanics (BM) is a theory of quantum mechanics without observers (Bricmont, Dürr, Galavotti, Ghirardi, Petruccione & Zanghi, 2001; Bell 2004; Golstein 1998a; Goldstein 1998b). It is a nonlocal hidden variables theory. The hidden variables are the exact positions of each particle. There are two main concepts: The wavefunction, and the particle positions. Wavefunction evolves according to the Schrödinger equation (Bricmont et al, 2001, p. 115):

$$i\hbar\frac{\partial\Psi}{\partial t} = \quad H\Psi. \tag{1}$$

On the other hand, the velocity of particles are guided by the wavefunction using the probability current (Bricmont et al, 2001, p. 115):

$$\vec{v}_k = \frac{\hbar}{m_k}\frac{\Im\left(\Psi^*\vec{\nabla}_k\Psi\right)}{\Psi^*\Psi}, \tag{2}$$

where k runs in particle numbers and $\Im(\cdot)$stands for the imaginary part of the term inside the parenthesis. Be aware that the Equation (2) is a first order differential equation. Therefore, the particle paths never cross each other.

Shape Dynamics (SD) is first initiated by Barbour where a simple introduction is given in (Barbour, 2012) and then made compatible with Einstein's general theory of gravitation (GR) by including other researchers (Barbour, & Murchadha, 1999; Anderson, Barbour, Foster, & Murchadha, 2003; Anderson, Barbour, Foster, Kelleher, & Murchadha, 2005; Gomes, Gryb, & Koslowski, 2011; Gomes, & Koslowski, 2012). Readers may see (Mercati, 2014) for a review of SD. The fully developed SD has the same reduced configuration space as GR but possesses a different gauge group. The gauge group of SD is local scale (Weyl) symmetry whereas in GR we have local Lorentz symmetry. SD is a fully Machian theory. The version of SD we consider in this paper is Julian Barbour's non-relativistic version (Barbour, 2012). The reason we use this version of SD is that BM is also non-relativistic.

SD considers inner-particle separations and and their time derivatives as the true relational variables. In an N-particle system there are $N(N-1)/2$ many inter-particle separations. If we move on to Newtonian absolute space there are $3N$ many variables in a 3D space. For that reason, we will use the Newtonian absolute space. In order to make a theory Machian, SD comes with various constraints in Newtonian absolute space. Therefore, Newton's absolute space can be used as long as the following constraints are satisfied and the theory will be Machian regardless (we modified the constraints appearing in (Barbour, 2012) according to quantum mechanics):

$$H\Psi = 0, \tag{3}$$

$$\sum_k \vec{L}_k \Psi = 0 \tag{4}$$

$$\sum_k \vec{r}_k \cdot \vec{p}_k \Psi = 0 \tag{5}$$

where $\vec{L}_k = \vec{r}_k \times \vec{p}_k$ and $\vec{p}_k = -i\hbar\vec{\nabla}_k$ as usual. The first is the energy constraints, the second is the angular momentum constraint and finally the third is the dilational momentum constraint.

The Machian Description of Bohmian Mechanics

In this section we will modify the SD constraints according to the BM variables and make BM Machian. In BM, we already have exact velocity of a particle. By multiplying it with the mass of the particle, one can find the exact momentum of that particle. Therefore, the use of momentum operator, $-i\hbar\vec{\nabla}_k$, is unnecessary. One may argue against our argument by saying that "While there is momentum operator in quantum mechanics, why do you not use it?" Our answer would be that the momentum operator in quantum mechanics is about making measurements. Its expectation value is the expected value of momentum. However, in BM we have the exact momenta of particles. Hence, it is natural to use them. As a note, please pay attention to the fact that momenta in BM are functions of the wavefunction, see Equation (2). The wavefunction still plays a central role in our description.

In a similar way, we can write down the orbital angular momentum as $m_k\vec{r}_k \times \vec{v}_k$ instead of $\vec{L}_k\Psi$. The Hamiltonian is kinetic energy plus the potential energy. The Hamiltonian constraint can be wrote down as follows instead of $H\Psi = 0$:

$$H_{BM} = \sum_k \frac{1}{2} m_k v_k^2 + \frac{1}{2}\sum_{k,k'} V(\vec{r}_k, \vec{r}_{k'}) = 0. \tag{6}$$

We added a subscript BM to H in order to mark that it is calculated using the particle positions. All in all, the equations of motion in BM remains the same:

$$i\hbar\frac{\partial\Psi}{\partial t} = H\Psi. \tag{7}$$

$$\vec{v}_k = \frac{\hbar}{m_k}\frac{\Im\left(\Psi^*\vec{\nabla}_k\Psi\right)}{\Psi^*\Psi}, \tag{8}$$

where H is the usual Hamiltonian from the quantum mechanics. The constraints on the other hand are as follows:

$$H_{BM} = \sum_k \frac{1}{2} m_k v_k^2 + \frac{1}{2}\sum_{k,k'} V(\vec{r}_k, \vec{r}_{k'}) = 0, \tag{9}$$

$$\vec{L}_{BM} = \sum_k m_k \vec{r}_k \times \vec{v}_k = 0, \tag{10}$$

$$D_{BM} = \sum_k m_k \vec{r}_k \cdot \vec{v}_k . \tag{11}$$

Machian BM solutions are those that satisfy the equations of motion and the constraints.

Conclusion

In this paper, we introduced Bohmian mechanics and shape dynamics. Bohmian mechanics has been made Machian by supplementing its equations of motion by appropriate shape dynamics constraints. It is no surprise that Bohmian mechanics uses Newtonian absolute space as it is the case with the orthodox quantum mechanics. However, the use of absolute space by Bohmian mechanics is allowed if the solutions respect the shape dynamics constraints and the theory is Machian when supplemented with these constraints.

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BREAST CANCER CLASSIFICATION USING K-NEAREST NEIGHBORS ALGORITHM

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Abstract: Breast cancer is a very common disease around the world and the second leading cause of cancer death in women. Expert systems are developed using data mining methods in order for disease diagnosis and significant tools for assisting medical doctors in their clinical decision. In this study, *k*-Nearest Neighbors algorithm (*k*-NN) was used in order to classify breast cancer disease. Besides, *k*-NN was implemented for different *k* values and the obtained classification accuracies were compared with each other. According to the study results, it was seen that breast cancer disease was successfully classified using *k*-NN.

Keywords: Breast Cancer, Classification, Data Mining, Expert Systems, *k*-Nearest Neighbors Algorithm

Introduction

According to the recent studies, breast cancer is the most common cancer in young women (Jelen et al., 2016). Among all cancers, it causes the second highest number of deaths around the world (Mittal et al., 2017; DeSantis et al., 2014; Misek and Kim, 2011). Nearly 1.7 million women suffer from breast cancer every year (Tang et al., 2016). In 2012, breast cancer was the reason for 18.3% of all cancer cases in Egypt (Abdel-Zaher and Eldeib, 2016; Salama et al., 2012). In 2015, approximately 481 women were diagnosed with breast cancer every week in Canada according to the statistics of the Breast Cancer Society of Canada (2015).

Disease diagnosis is a very sophisticated process in medicine. In order to diagnose a disease accurately, several tests are required. Computer-aided diagnostic tools, expert systems, assist physicians to make primary decision for early diagnosis. Thanks to early detection of a disease, treatment process can be minimized and patients' lives may be saved. Especially in breast cancer, medical doctors desire to know the condition of the patient early who has benign or malignant case. Computer-aided diagnostic tools classify benign or malignant cases successfully in order for detection of breast cancer disease (Jelen et al., 2016). In this study, *k*-Nearest Neighbors algorithm (*k*-NN) is utilized to classify breast cancer disease as benign or malignant.

The rest of the paper is organized as follows. Materials and Methods Section introduces the classification of breast cancer disease using *k*-NN and the dataset used. In Results and Discussion Section, the experiments including classification accuracies and error values of the methods used in this study are demonstrated. Finally, conclusions being under study are summarized in Conclusion Section.

Materials and Methods

In this section, the dataset of breast cancer diagnosis used in this study is described. Then, the algorithm used for classification of breast cancer disease is explained.

Dataset Description

In order to classify breast cancer disease, Wisconsin Breast Cancer Database was used. The dataset was created by Dr. William H. Wolberg from the University of Wisconsin (Wolberg, 1991). It is available online in Machine Learning Repository at the University of California - Irvine (Lichman, 2013). The dataset contains 699 instances. There are 11 attributes which are sample code number, clump thickness, uniformity of cell size, uniformity of cell shape, marginal adhesion, single epithelial cell size, bare nuclei, bland chromatin, normal nucleoli, mitoses and class (benign or malignant). 458 (65.5%) instances are benign and 241 (34.5%) instances are malignant. There are 16 instances containing a single missing attribute value. The description of the attributes is shown in Table 1.

Table 1. Attributes of the Wisconsin Breast Cancer Database.

Attribute #	Attribute name	Domain	Mean	Standard deviation
1	Sample code number	Id number	-	-
2	Clump thickness	1 - 10	4.418	2.816
3	Uniformity of cell size	1 - 10	3.134	3.051
4	Uniformity of cell shape	1 - 10	3.207	2.972
5	Marginal adhesion	1 - 10	2.807	2.855
6	Single epithelial cell size	1 - 10	3.216	2.214
7	Bare nuclei	1 - 10	3.545	3.644
8	Bland chromatin	1 - 10	3.438	2.438
9	Normal nucleoli	1 - 10	2.867	3.054
10	Mitoses	1 - 10	1.589	1.715
11	Class	2 for benign 4 for malignant	-	-

Classification with *k*-Nearest Neighbors Algorithm

k-NN is a widely used pattern classification technique because of its simplicity and efficiency (Eyupoglu, 2016; Zhang et al., 2012; Wang et al., 2007). Furthermore, *k*-NN, a versatile multivariate statistical method, utilizes standard Euclidean distance and evaluates the distinguishing features. It makes no assumption with regard to the statistical structure of the data (Niwas et al., 2013; Shakhnarovish et al., 2005).

k-NN estimates class attribute depending the *k* nearest training examples in the feature space. When a dataset is given, it chooses the *k* nearest samples from the classified training data and determines the class considering the most representative samples. Euclidean distance similarity metric is used to select the neighborhoods and calculated using Eq. (1) as follows (Shen et al., 2016):

$$\text{Euclidean distance} = \sqrt{\sum_{i=1}^{n} (x_i - y_i)^2} \quad (1)$$

where x_i and y_i are two points in Euclidean *n*-space. After all test samples are classified by *k*-NN, the classification accuracy is calculated with dividing the number of correctly classified samples by the total number of samples. Mean absolute error (MAE) is calculated according to the following Eq. (2) as follows (Willmott and Matsuura, 2005):

$$\text{MAE} = \frac{1}{n}\sum_{i=1}^{n} |y_i - x_i| \quad (2)$$

where y_i is the prediction value and x_i is the real value. Root mean square error (RMSE) is calculated using Eq. (3) as follows (Willmott and Matsuura, 2005):

$$\text{RMSE} = \sqrt{\frac{1}{n}\sum_{i=1}^{n} |y_i - x_i|^2} \quad (3)$$

Results and Discussion

In this paper, *k*-NN was used to classify breast cancer disease and implemented for different k-fold cross-validation and *k* values. Then, the obtained classification accuracies were compared with each other. The application used for classification was implemented using Weka 3.8 software. Weka (Waikato Environment for Knowledge Analysis) was developed by Machine Learning Group at the University of Waikato in New Zealand. It is a collection of machine learning algorithms and data preprocessing tools for data mining tasks (Witten et al., 2011). The tests were performed for 2-fold, 5-fold and 10-fold cross-validation and *k* values were ranging from 1 to 20. The classification accuracies of *k*-NN for different k-fold cross-validation and *k* values were presented in Table 2.

Table 2. Classification accuracies of *k*-NN for different k-fold cross-validation and *k* values.

k	2-fold cross validation	5-fold cross validation	10-fold cross validation
	Classification accuracy (%)	Classification accuracy (%)	Classification accuracy (%)
1	95.8512	95.4220	95.1359
2	94.5637	94.5637	94.4206
3	96.8526	96.7096	96.8526
4	95.9943	96.4235	96.7096
5	96.1373	96.5665	96.9957
6	96.1373	96.2804	96.7096
7	96.4235	96.2804	96.7096
8	96.2804	96.1373	96.1373
9	96.4235	96.2804	96.2804
10	96.2804	95.9943	96.4235
11	96.1373	96.2804	96.2804
12	96.1373	96.1373	96.2804
13	96.1373	96.2804	96.1373
14	96.1373	96.2804	96.1373
15	96.1373	96.4235	96.4235
16	95.9943	96.4235	96.7096
17	96.1373	96.4235	96.5665
18	95.9943	96.4235	96.4235
19	96.1373	96.4235	96.5665
20	95.8512	96.4235	96.4235

As seen from Table 2, the classification accuracies of *k*-NN range from 94.4206% to 96.9957%. For 2-fold, 5-fold and 10-fold cross validation techniques, the classification accuracies vary between 94.5637% - 96.8526%, 94.5637% - 96.7096% and 94.4206% - 96.9957%, respectively. The best classification accuracies of 2-fold, 5-fold and 10-fold cross validation techniques are obtained for k=3, k=3 and k=5, and these rates are 96.8526%, 96.7096% and 96.9957%, respectively. As a result, the classification accuracy of nearly 97% was achieved using *k*-NN. Moreover, the error values of *k*-NN for different k-fold cross-validation and *k* values were shown in Table 3.

Table 3. Error values of *k*-NN for different k-fold cross-validation and *k* values.

k	2-fold cross validation		5-fold cross validation		10-fold cross validation	
	MAE	RMSE	MAE	RMSE	MAE	RMSE
1	0.0441	0.2031	0.0474	0.2136	0.0501	0.2202
2	0.0435	0.1722	0.0452	0.1813	0.0444	0.1763
3	0.0447	0.1634	0.0463	0.1719	0.0444	0.1672
4	0.0493	0.1648	0.0469	0.1659	0.0454	0.1659
5	0.0523	0.1703	0.0467	0.1594	0.0458	0.1596
6	0.0522	0.1681	0.0480	0.1600	0.0460	0.1559
7	0.0525	0.1668	0.0491	0.1605	0.0472	0.1566
8	0.0541	0.1692	0.0506	0.1630	0.0481	0.1584
9	0.0535	0.1675	0.0514	0.1630	0.0491	0.1595
10	0.0536	0.1684	0.0526	0.1660	0.0503	0.1585
11	0.0545	0.1692	0.0532	0.1665	0.0508	0.1603
12	0.0551	0.1713	0.0540	0.1653	0.0510	0.1612
13	0.0554	0.1715	0.0542	0.1648	0.0522	0.1629
14	0.0557	0.1719	0.0539	0.1641	0.0526	0.1622
15	0.0556	0.1723	0.0543	0.1650	0.0526	0.1617
16	0.0552	0.1719	0.0545	0.1657	0.0524	0.1617
17	0.0559	0.1734	0.0553	0.1672	0.0530	0.1628
18	0.0565	0.1748	0.0549	0.1670	0.0531	0.1625
19	0.0568	0.1756	0.0554	0.1672	0.0537	0.1643
20	0.0563	0.1754	0.0555	0.1678	0.0541	0.1653

According to Table 3, MAE and RMSE values range between 0.0435 - 0.0568 and 0.1559 - 0.2202. For 2-fold, 5-fold and 10-fold cross validation techniques, MAE and RMSE values vary between 0.0435 - 0.0568, 0.0452 - 0.0555 and 0.0444 - 0.0541; 0.1634 - 0.2031, 0.1594 - 0.2136 and 0.1559 - 0.2202, respectively. The minimum MAE values of 2-fold, 5-fold and 10-fold cross validation techniques are obtained for k=2. For RMSE, the minimum values are attained for k=3, k=5 and k=6, respectively. Consequently, the error values of 0.0435 and 0.1559 for MAE and RMSE were procured by *k*-NN. The change of error values with the increase of *k* values can be easily observed from Figure 1.

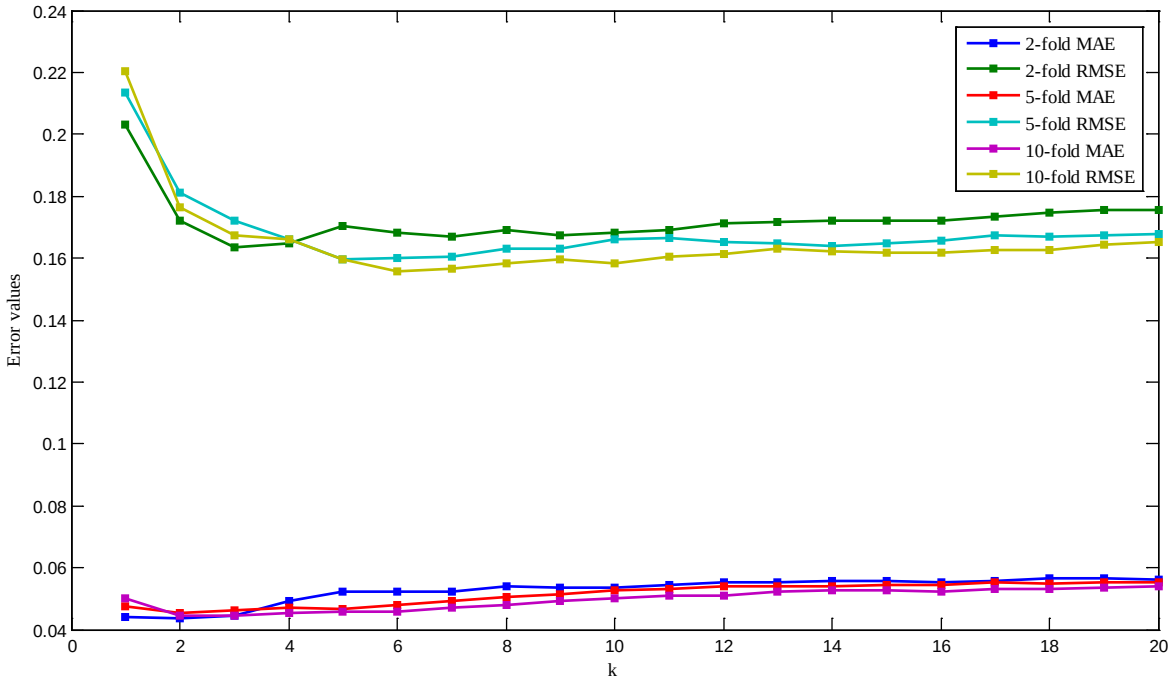

Figure 1. Change of error values with the increase of *k* values.

Conclusion

In this paper, in order to classify breast cancer disease as benign or malignant, *k*-NN was utilized. It was implemented for 2-fold, 5-fold and 10-fold cross validation and different *k* values. The classification accuracies and error values were attained to assess the success of *k*-NN. According to the test results, the achieved classification accuracy of *k*-NN is approximately 97%. Besides, the study results show that *k*-NN is an effective classifier in order for classifying breast cancer disease.

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DEVELOPMENT OF A COMPLETE AUTOSAR 4.0 SOFTWARE PROJECT WITH THE AUTOSAR EDUCATION ENVIRONMENT

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Abstract: The automotive industry introduced the AUTOSAR standard for the development of software for automotive electronic control units. With the availability of the AUTOSAR Education Environment, students have the possibility to work with AUTOSAR-related hard- and software. This article gives information about the realisation of a first complete AUTOSAR 4.0 Software Project at Institut für Regelungs- und Steuerungstechnik (Institute of Automatic Control Engineering) of Universität Siegen.
Keywords: AUTOSAR Education Environment, AUTOSAR 4.0 Software Project

Introduction

The term AUTOSAR stands for **AUT**omotive **O**pen **S**ystem **AR**chitecture and is an international standard of the automotive industry. AUTOSAR describes a reference architecture for the software of electronic control units. The goal of this standardisation is to keep the growing amount of software with increasing complexity manageable (Kindel & Friedrich, 2009).

Besides the standard itself, the term AUTOSAR is used for the international development partnership that develops the standard as well. Vehicle manufacturers, their suppliers and other companies from the electronics, semiconductor and software industry are members of this partnership.

This development partnership maintains the website https://www.autosar.org/ where the standard can be downloaded for informational purposes. The commercial use of this information is restricted to AUTOSAR-members.

In order to give students the possibility to work with AUTOSAR-related hard- and software the company Vector Informatik (from Stuttgart, Germany), an AUTOSAR-member, has developed the AUTOSAR Education Environment. The hardware included in the Education Package is an automotive electronic control unit (ECU) and a Hardware Debugger for transferring the developed software to the microcontroller in the ECU and of course for debugging the developed program code. The customer can either directly connect his own hardware or has the choice between two different breakout-boxes. On the software side the Education Environment includes parts of Vector Informatik's own AUTOSAR implementation and several software tools for ECU software development and debugging.

We at the Institut für Regelungs- und Steuerungstechnik (Institute of Automatic Control Engineering) of Universität Siegen bought the AUTOSAR Education Environment. Software development for microcontrollers is not something new to us – we did it several times for microcontrollers of different manufacturers. However, since the development of software according to the AUTOSAR standard is very domain specific, several things were new to us. Therefore, the goal of our first student project was to develop a complete AUTOSAR 4.0 Software Project and to document the complete workflow that is necessary to set up the project. The created documentation cannot replace the support if one has a specific problem but it is good basis for further projects.

The first part of this document will cover information that is more general and gives a brief overview of the basic ideas and concepts of the AUTOSAR standard. It introduces the reader to the workflow that is established with the standard – the so-called AUTOSAR-Methodology as well.

The second part of this document will give an overview of the realised AUTOSAR 4.0 Software Project at Universität Siegen.

Part I: Overview of the basic ideas and concepts of the AUTOSAR standard

This part of the document has no claim to give a complete overview of the AUTOSAR standard. Instead, a brief explanation of some basic ideas and concepts are shared for a good understanding.

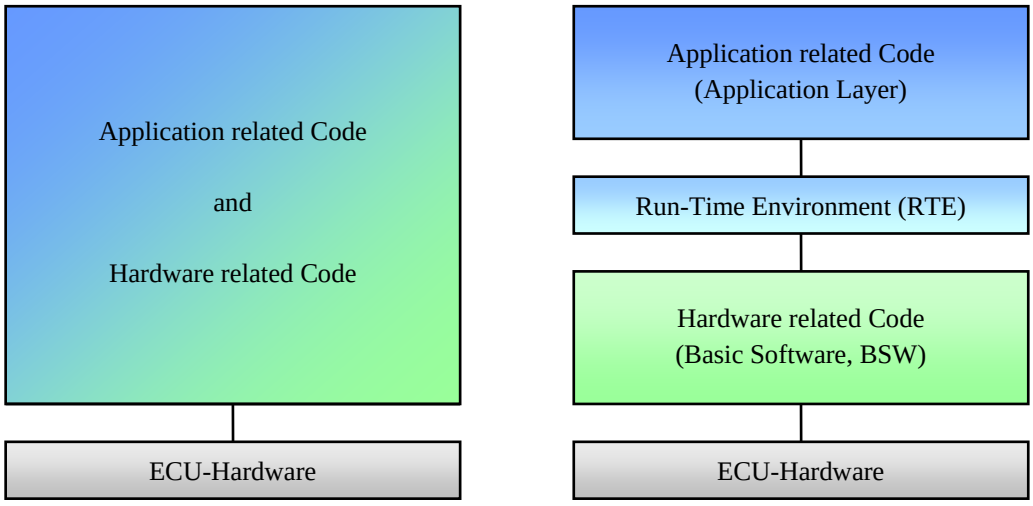
The implementation of a layered architecture

AUTOSAR implements the so-called AUTOSAR Layered Software Architecture (Kindel & Friedrich, 2009). This architecture describes several abstraction layers for software of an ECU: The Application Layer, the Run-Time Environment and the Basic Software. The Basic Software is the layer directly above the ECU-Hardware. Figure 1 (b) shows the structure of this architecture. In such architecture, the interfaces between the layers are well defined. One layer uses the functionality provided by the layer below and itself provides functionality to the layer above. If an error has to be corrected in one of the layers, only the implementation of that specific layer needs correction since the interfaces between the layers remain unchanged. The layer architecture therefore supports the modularity of the software.

Preliminary to the introduction of AUTOSAR, there was not necessarily a layered architecture present in the software of an ECU. This is illustrated in Figure 1 (a).

The layered architecture may remind one of the OSI reference model from the International Organization for Standardization (ISO) (Meinel & Sack, 2012). The OSI reference model is commonly used for explaining the structure of the Internet protocol (TCP/IP). The intension behind both reference models is comparable: The Interfaces between the different layers are defined and hardware dependence decreases as you move up the layers.

The Basic Software (BSW) can be regarded as an operating system that is responsible for hardware abstraction. The Application Layer contains the Software Components with the Application related Code and the Run-Time Environment (RTE) implements the communication between the different Software Components and between Software Components and the Basic Software.



a) Classical ECU b) AUTOSAR-ECU

Figure 1. Comparison of the software structure in a Classical ECU (a) and an AUTOSAR-ECU (b) (see also Figure 3-2 in Kindel & Friedrich (2009)).

The procedure to get executable code for an ECU: The AUTOSAR-Methodology

Several companies deliver the electronic control units in a vehicle. In order to manage and to parallelise the development of these control units for the vehicle the AUTOSAR-Methodology was introduced (Kindel & Friedrich, 2009), (AUTOSAR, 2008). The Methodology describes a procedure or a "Work Product Flow" to get executable code for an ECU. The necessary information for the work product flow is usually stored in xml-files. Normally software tools intensively support the work steps and a by hand modification of the xml-files should not be necessary. Figure 2 gives a simplified overview of the AUTOSAR-Methodology.

The Methodology consists of three views: The System View (red), the ECU View (blue) and the Component View (green). The System View with the System Configuration (1) contains descriptions about all Software Components, ECUs, communications links and system restrictions of a vehicle. The Software Components will be assigned to a certain ECU when the system is configured (2). From the resulting System Configuration Description (3), one can conclude which data has to be exchanged between the ECUs. Since not all ECUs and Software Components come from the same supplier, ECU Views and Component Views can be extracted (4) from the System View. The different views allow a parallelization of the complete development process for all ECUs and Software Components. Software Components that have been developed with the help of the Component View and in parallel to everything else can be integrated into an ECU (14) as binary code.

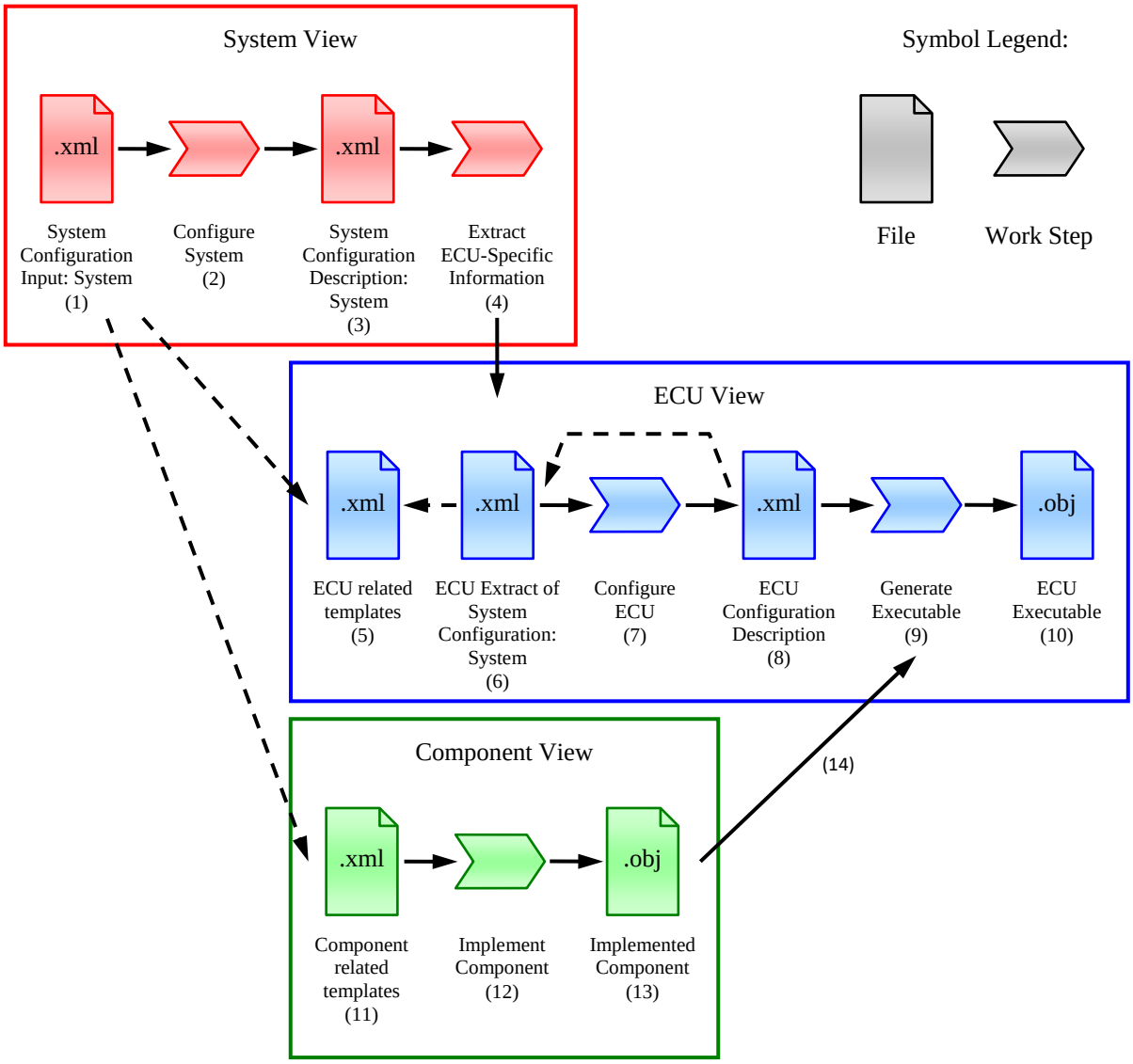


Figure 2. Simplified overview of the AUTOSAR-Methodology (see also Figure 5-10 in Kindel & Friedrich (2009)).

With the help of the ECU related templates (5) and the ECU specific extract of System Configuration (6) one ECU can be developed. If this information is given, the ECU can be configured (7) in the next step. This configuration step includes for example the selection and configuration of the modules of the Basic Software that are needed to realise the functionality and the configuration of the task scheduler of the operating system. The result of the configuration step (7) is the ECU Configuration Description (8). The work step generate executable (9) includes the generation of source code (for example for the Run-Time Environment or the Basic Software), the compilation of the source code (for example of the generated source code or of the Software Components that are given form of source code) and finally linking all the object files together to an executable program (10).

With the help of the Component related templates (11) a Software Component or several versions of a Software Component can be implemented (12). The implemented Software Component is an object file (13) that can be integrated into an ECU (14) in link stage of the executable generation (9).

The Communication between Software Components and the Virtual Functional Bus

The Virtual Functional Bus (VFB) describes abstract communication relations between Software Components (SW-C) in the System View (Kindel & Friedrich, 2009), (AUTOSAR, 2010). During the System Configuration, all Software Components will be assigned to the respective ECUs. According to the AUTOSAR-Methodology, the Configurations of all ECUs (No. 6 in Figure 2) are extracted (No. 4 in Figure 2) from the System Configuration (No. 3 in Figure 2). Figure 3 illustrates this step of development that is carried out with the help of software tools.

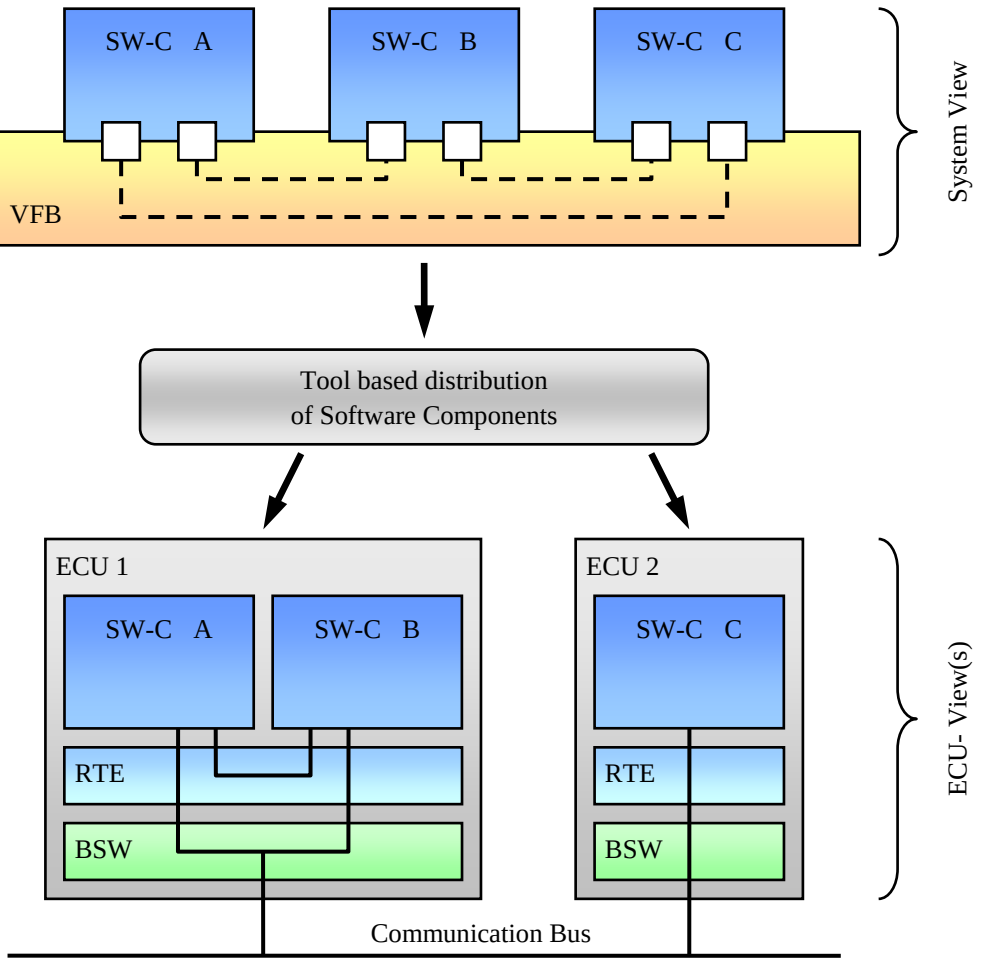


Figure 3. Tool based distribution of Software Components across ECUs (see also Figure 6-2 in Kindel & Friedrich (2009)).

When the ECU Views are generated, the abstract communication relations between Software Components will be replaced by concrete communication connections. For this step, it does not matter if the communication takes place between two Software Components on the same ECU or if the communication has to be established across a Communication Bus. This flexibility is reached by the auto-generation of the Run-Time Environment that realises the communication connections between the Software Components.

If there are problems in one ECU regarding the computational power of the CPU, the System Configuration can be modified and the extraction of the ECU Configurations can be repeated. A prerequisite for this flexibility within the distribution of Software Components is that there are enough free communication resources on the communication bus. A constrain that two Software Components have to be assigned to the same ECU can restrict this flexibility.

The structure of the Basic Software

Within the layered architecture the Basic Software is located below the Run-Time Environment and above the ECU-Hardware. In addition to that, the Basic Software itself is subdivided into three horizontal abstraction layers and six vertical sections (Kindel & Friedrich, 2009). Figure 4 illustrates the location of the Basic Software in the layered architecture and the structure of the Basic Software itself.

The vertical subdivision of the Basic Software results in the following six sections (from left to right): System Services, Device Stack, Memory Stack, Communication Stack, I/O-Stack and Complex Device Drivers. The three horizontal Abstraction Layers are (from bottom to top): Microcontroller Abstraction Layer (MCAL), ECU Abstraction Layer and Service Layer.

The section System Services provides basic functionality as operating system-, diagnostic- and ECU State Management functions to Application Software Components and to other modules of the Basic Software. The Device Stack abstracts Microcontroller internal Hardware like the Watchdog and the Timers. The Memory Stack provides unified access to non-volatile memories as Flash-Memories and EEPROMs.

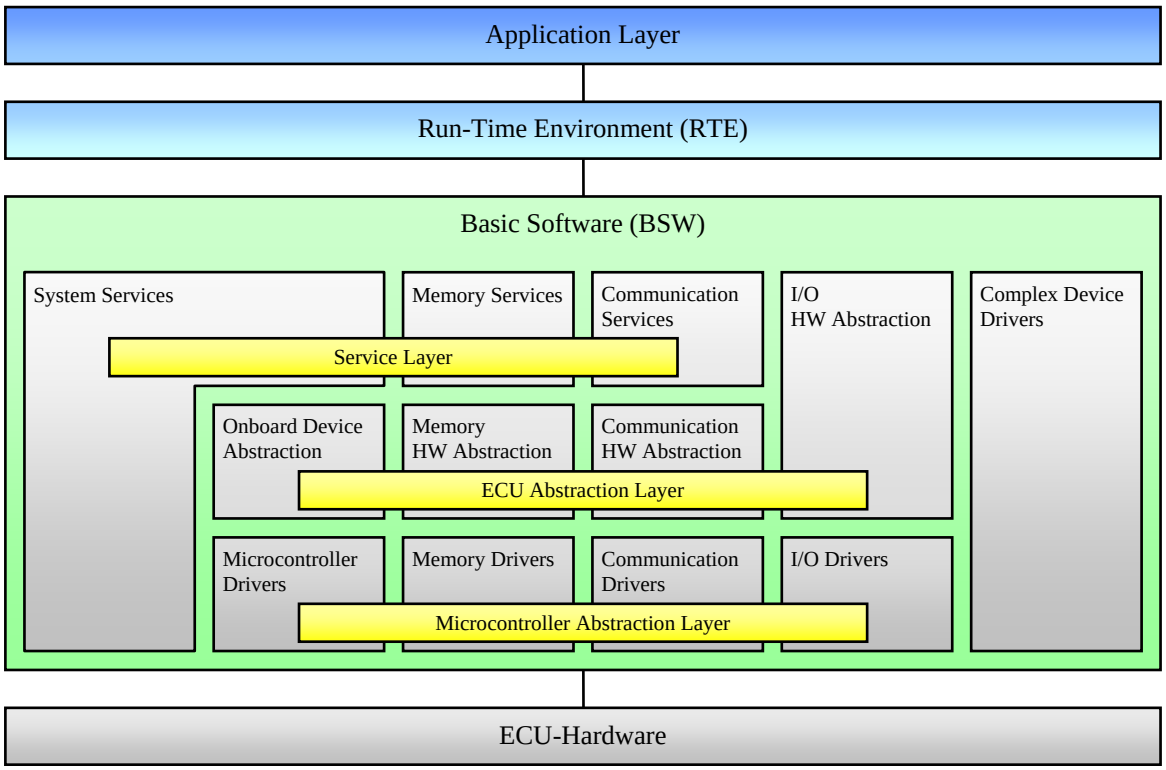


Figure 4. Structure of the layered architecture and substructure of the Basic Software (see also Figure 9-2 in Kindel & Friedrich (2009)).

The Communication Stack provides communication services to the Application- and the Basic Software in order to exchange data with other electronic control units. The abstraction within this stack is done in a way that applications can be developed independently from the type of communication bus they use. The I/O-Stack provides access to analog-, digital- and PWM I/O-Pins of the ECU.

The section Complex Device Drivers does not belong to any layer of the Basic Software and is not specified in detail. A Complex Device Driver provides the possibility to integrate new modules into the AUTOSAR system. There can be three reasons why a Complex Device Driver is implemented: 1. A module for a special functionality is missing, 2. There are timing requirements that cannot be fulfilled with AUTOSAR and 3. Existing software shall be ported to AUTOSAR step by step.

Part II: Overview of the realised AUTOSAR 4.0 Software Project

This second part of this article will give an overview of the complete AUTOSAR 4.0 Software Project (Khound, 2017) realised by Mr. Parthib Khound, student in the master course Mechatronics at Universität Siegen. A second work of Mr. Jaysheel Mehta, also student in the master course Mechatronics, is still in progress.

Overview of the Hardware in the System

The block diagram in Figure 5 gives an overview of all hardware components that were used during the development of the AUTOSAR 4.0 Software Project. The ECU (1), for which the Software Project was developed, can be seen on the left side of the diagram. The ECU is mounted on a Breakout Box (2). The Breakout Box contains some input/output elements like switches, adjustable resistors, LEDs and connectors for several types of busses. The three LEDs numbered with 10 up to 12 and the connector for the CAN-Bus are used in this project. The Hardware Debugger (3) which is mounted on top of printed board of the ECU is used to flash the generated program code to the ECU and can of course be used to debug the developed program code. The Hardware Debugger is connected via USB link to a PC (4) that is used for software development and debugging.

The primary data source in our system is a 3D Acceleration Sensor with an additional temperature sensor (5), that sends its measured data periodically on the CAN Bus. The CAN Bus Interface (6) is used to monitor the data on the CAN Bus. The CAN Bus Interface is connected to the PC via USB link.

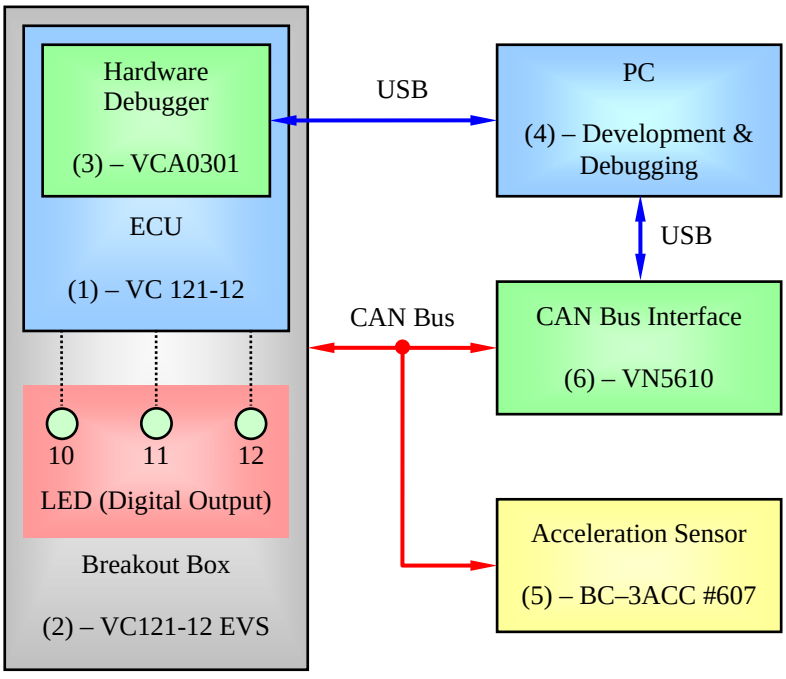


Figure 5. Block diagram of the relevant components in the overall system.

Most of the hardware such as the ECU (Type: VC 121-12), the Breakout Box (Type: VC121 12 EVS) and the CAN Bus Interface (Type: VN5610) come directly from Vector Informatik. The Hardware Debugger is a product of the company iSYSTEM AG and is sold by Vector Informatik (Type: VCA0301). The Acceleration Sensor (Type: BC–3ACC #607) was thankfully provided by 2D Debus & Diebold Meßsysteme GmbH.

Overview of the software used to develop the project

All software that was used to develop the code for the ECU is listed in Table 1. In the project described here, only one ECU is present. Therefore, the work steps within the ECU View (see Figure 2) of the AUTOSAR-Methodology were important for us. In our case, there is no System Configuration or System Configuration Description. Therefore, the configuration for the ECU could not be extracted from it. We had to create the ECU Configuration by ourselves. For configuration purposes, the DaVinci Configurator Pro (1) was used.

In order to implement the functionality described in the next chapter, the ECU needs to communicate. It receives the messages from the Acceleration Sensor and transmits messages after processing the data of the sensor. The easiest way to set up the communication is to describe the structure of the messages on the bus in a database file and add this file to the configuration. The DaVinci Configurator Pro adjusts many settings in the project according to the CAN database files. The CAN messages database files themselves can be created with CANdb++ (2).

The creation of Software Components and skeletons for Application Code has been done with DaVinci Developer (3).

CANoe (4) is a tool for monitoring and analysation of data on a bus. In order to bring the collected data to the user's eyes self-defined virtual panels can be created in CANoe. Beyond this, the software has the ability to simulate complete ECUs or complete networks of ECUs (residual bus simulation). What type of bus can be accessed by CANoe depends on the type of bus interface you have.

winIDEA (5) is the software that gives you access to the Hardware Debugger mounted on top of the board of the ECU. The developed program code can be flashed to the ECU with the help of this software and it can be of cause used for debugging.

A GNU toolchain (6) is used to compile and link the developed software for the microcontroller in the ECU.

No.	Software	Developer	Description
1	DaVinci Configurator Pro	Vector Informatik	Configuration and Generation of the Basic Software and the Run-Time Environment
2	CANdb++	Vector Informatik	Creation of CAN Bus communication database files
3	DaVinci Developer	Vector Informatik	Creation of software components and skeletons for application code
4	CANoe	Vector Informatik	Monitoring, Analysation and Simulation of communication bus signals
5	winIDEA	iSYSTEM	Software for flashing the generated program code to the ECU and for debugging of the developed software
6	GNU toolchain	Free Software Foundation, Red Hat (Software)	Compiler and Linker for the ECU-Hardware

Table 1. List of Software used in this project.

Overview of the developed functionality

The implemented functionality of the ECU can be subdivided into two periods. The first period is the first six seconds after the ECU is started. The second period is the time after the first six seconds.

Within the first six seconds, the ECU will let the LEDs 10, 11 and 12 glow one after another. This can be regarded as a dummy replacement for a self-test function that is executed after the ECU is started.

Six seconds after the ECU has been powered, the main algorithm is started. Within the main algorithm, the ECU receives the data from the Acceleration Sensor via CAN Bus, evaluates the received data, retransmits a CAN frame and controls the LEDs 10, 11 and 12. The data of the Acceleration Sensor and the data coming from the ECU can both be evaluated and viewed in the software CANoe on the PC.

The Acceleration Sensor transmits its measured data periodically on the CAN Bus. This data includes the accelerations in x-, y- and z-direction plus the temperature of the sensor. The ECU checks all four values against threshold values and transmits a CAN message which contains information if the measured values are is below or above their corresponding threshold values. Additionally, the ECU will let the LEDs 10, 11 and 12 glow if the acceleration in x-, y- or z-direction exceeds the corresponding threshold. As already mentioned, the data of the Acceleration Sensor as well as the status values transmitted by the ECU are visualised by CANoe.

Summary

Vehicle manufacturers require that the software of new developed automotive electronic control units are developed according to the AUTOSAR standard. The standard itself introduces a Layered Software Architecture and a work product flow called AUTOSAR-Methodology that describes how software for an ECU can be developed according to the standard. The included concept of the Virtual Functional Bus provides the possibility to move software components between ECUs and increases thereby flexibility. The Basic software provides many services and functionality to the Run-Time Environment and the application software. Therefore, it can be regarded as something like an operating system. Unlike an operating system for a personal computer, the Basic software is not delivered preconfigured. This is a task the user has to perform. Since a lot of flexibility is requested, this task can be difficult. With the help of the AUTOSAR Education Environment, a first complete AUTOSAR 4.0 Software Project could be developed. The created documentation is good basis for further AUTOSAR projects.

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ECO BAKERY FOR FRIENDLY ENVIRONMENTS IN ECOLOGICAL - CASE STUDY FROM THAILAND

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Abstract : According to the United Nations of Sustainable Development Goal 2030 (SDG 2030) 17 topic concepts of which were announced and demonstrate the scale of the universal Agenda for seeking to build on the Millennium Development Goals to complete achievement in economic, social and especially in environmental.

The Goals and targets will encourage action in areas of critical importance for humanity and the planet; in social development sector in Bangkok, Thailand has setting up the developed project in the business training for bakery new entrepreneur based on the SDG2030 compositions which has combined within the concept by using the Eco techniques and practices. To issue healthy product for customer by the key success idea of production practices has realized for environment concerning, energy and reserving resource were saving, from the beginning to end of process; as raw material preparing such as; use the organic and non-hazardous which are the main materials and purified mixed such as; gluten-free, trans fat free, low sugar, low GI, low sodium and non-genetically engineered or non-injections products as the ingredients.

By selected the baking technique which has energy saving of less electricity power, gas, wind and water supplied and used the packaging which can be decomposed in naturally instated of foam packages types. To deliver the best qualities to customer and friendly environments till the last consumer in life-cycle chain as fish and other spicy in environment.

After the project has implementation, Eco bakery, the contribution of Eco bakery production has selected to evaluation by SDG2030 concept of No. 14 to ensure the products has friendly with the environment or not, , "Eco bakery" which has been created the problem pollutions for the river for long time ago by Thailand traditional yearly festival.

Eco bakery, which produces by SDG2030 concept as selected to be the treatment of the experimental research was launched into the rivers and the seas in Thailand. The research has operated to study the difference of water quality as BOD (Biological Oxygen Demand) Value and DO (Dissolved Oxygen) Value that have analyzed by Laboratory in Thailand . The research has operated found out the results has accepted the hypothesis at level with significance.

Therefore, ECO Bakery for Friendly Environments in Ecological – cased studied of Eco bakery in Thailand, has been the optional of the integrated and indivisible of SDG 2030 for water pollution solution in action for environmental matters.

Keywords: ECO Bakery, SDG 2030, Eco bakery, Friendly Environments in Ecological – cased studied, Cased studied of SDG 2030 for water pollution solution, Action for environmental.

Introduction

This Agenda is a plan of action for people, planet and prosperity. It also seeks to strengthen universal peace in larger freedom. That eradicating poverty in all its forms and dimensions, including extreme poverty, is the greatest global challenge and an indispensable requirement for sustainable development. These are universal goals and targets which involve the entire world, developed and developing countries alike. They are integrated and indivisible and balance the three dimensions of sustainable development in a balanced and integrated manner (UN SDG 2030 Agenda, 2015). The solving also to create conditions for sustainable, inclusive and sustained economic growth, shared prosperity and decent work for all, taking into account different levels of national development and capacities. All countries have acting in collaborative partnership, will implement this plan and environmental. It is important to recognize the link between sustainable development and other relevant ongoing processes in the economic, social and especially in environmental fields.

Figure1. UN SDG 2030

Because the importance of ensuring the integrity of all ecosystems, including oceans, and the protection of biodiversity, recognized by some cultures as Mother Earth, and noting the importance for some of the concept, that we focused on that part to develop the project on the matters addressed in this Agreement. (Paris Agreement, 2015)

Figure2. Sustainable Development Goal 2030 Articles

This is the concept of bakery business which has supported some topic base on UN SDG 2030 in several goals by applied. It's mention focus on friendly environments in Bakery business. Its segment functions by bakery technologies and bakery management by practices.

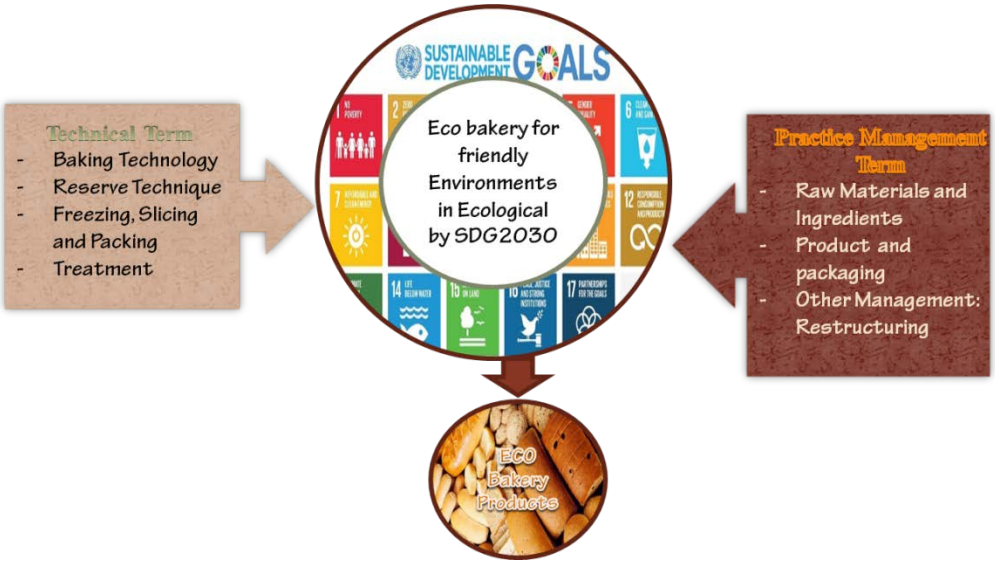

Figure3. Functional-concept framework.

The functions convers from the beginning till end of process. The specific needs and special situations of the developed countries with regard to funding and transfer of technology (Paris Agreement, 2015) by separated between Technical Term and Practice Management term both functions have related with SDG 2030 concepts and the contribution was the ECO Bakery Products. Each technic module based on SDG concept as follows:

Technical Term

Goal 7: Affordable, reliable, sustainable and modern energy**.**

By use several baking technique by hi-tech of multiple machines, modern with updated but not too expensive and saves power of electricity, wind, gas. Included the freezing technique of freezing par-bake good, slicing and packing by uses the automatic machines of wrapping or bagging by saving energy machines and multifunction usages by the concept of Goal 7 (Paris Agreement,2015).

Practice Management Term

Goal 2: Nutrition Agriculture and Goal 12: consumption and production patterns, this will be implemented to reflect equity and the principle of common but differentiated responsibilities and respective capabilities, in the light of different national circumstances.

By raw materials and ingredients management: By selected the raw materials and ingredients by using the organic and non-hazardous, purified ingredients from non-genetically engineered animals and none injections.

Select the whole grain, cereal and seed for the mixing with zero-trans shortenings and Trans fat- free oil, which has made from high oleic soybean oil and keep clean for the all machines. It should be support Gluten free Flour, Non-Pho Shortening production.

Goal 15: Protect ecosystems, halt and reverse land degradation and halt biodiversity loss:

By select the safety packaging for the ecological system. That's can be decomposed naturally use non-foam type package, recycle paper instead of Plastic or foamed pattern.

Goal 8: Promote sustained economic growth, higher levels of productivity and technological innovation, full and productive employment and decent work for all.

By run bakery business for job creation, employs the disable person, gives a chance to unemployed, reduced inequalities and manage the other business parts as marketing, display, accounting and inventory by systematic and run business by fair price and fair job support the inclusive economic growth.

Materials and Methods

After implement, the bakery product were created as ECO product based on the concept of UN SDG # 14 (For ecological of river) to product the eco bakery product which friendly environment. Eco bakery, it's produced by gluten free four and healthy ingredients , were selected to evaluation by SDG2030 to ensure the products has friendly with the environment as the treatment of the experimental research was launched into the rivers and the river before the seas in Thailand.

Research Methods:

The study was conducted by using experimental research methodology by mixed method of qualitative and quantitative.

Population: Sampling by random

The sample of water 319 Samples from 3 rivers in northern and central and southern (before go out to the sea) each river 10 samples of water in 11 times with 100 treatments per each river.

The research has operated to study the difference of water quality as BOD (Biological Oxygen Demand) : Standard method for indirect measurement of the amount of organic pollution (that can be oxidized biologically) in a sample of water. BOD test procedure is based on the activities of bacteria and other aerobic microorganisms (microbes), which feed on organic matter in presence of oxygen. The result of a BOD test indicates the amount of water-dissolved oxygen (expressed as parts per million or milligrams per liter of water) consumed by microbes incubated in darkness for five days at an ambient temperature of 20°C. Higher the BOD, higher the amount of pollution in the test sample. For the contaminants that cannot be oxidized biologically, chemical oxygen demand (COD) method is used. And DO (Dissolved Oxygen) value: Oxygen is measured in its dissolved form as dissolved oxygen. If more oxygen is consumed than is produced, dissolved oxygen levels decline and some sensitive animals may move away, weaken, or die. To prove by Laboratory that fish and other aquatic animals under the river can also be eaten and can also be decomposed in nature. (Jan Sendzimir**,** 2014).

Figure4. Research Operation: Experimental.

Result and Discussion:

Data analyzed by SPSS statistical program when t-test is applied in determining the significant of the difference between pretest 3 times and posttest 3 times of each river by kept record or data for evaluation. The measurement used science parameters as BOD and DO (International Soil and Water Conservation Research, 2016)

Biological Oxygen Demand (BOD)

Table1: Mean of Posttest BOD3 level has the maximum of average score = 1.94 with SD = 0.23 and Posttest

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Posttest BOD1	319	1.49	0.50	0.02
Posttest BOD2	319	1.71	0.45	0.02
Posttest BOD3	319	1.94	0.23	0.01

BOD1 level has the minimum average score = 1.49 with SD = 0.50

Table2 : The descriptive show the statistic of posttest BOD of Eco bakery has Significant (α) > 0.05 % or 95% in posttest BOD3 level = 1.94 and critical t<1.91 to t> 1.96

One-Sample Test						
	Test Value = 0					
	t	df	Sig. (2 tailed)	Mean Diff	Lower	Upper
Posttest BOD1	53.33	318	0.00	1.49	1.44	1.55
Posttest BOD2	68.07	318	0.00	1.71	1.66	1.76
Posttest BOD3	150.20	318	0.00	1.94	1.91	1.96

Dissolved Oxygen (DO)

Table 3: Mean of Posttest DO 1 has the maximum of average score = 1.92 with SD = 0.52 and Posttest DO 3 level has the minimum average score = 1.52 with SD = 0.23

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
PosttestDO1	319	1.52	0.50	0.02
PostestDO2	319	1.74	0.43	0.02
PostestDO3	319	1.92	0.23	0.01

Table 4: The descriptive show the statistic of Pretest DO of Eco bakery has significant (α) >0.05% or 95% in Pretest DO 3 level = 1.92 and critical t<1.89 to t>1.95

	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
PosttestDO1	54.26	318	0.00	1.52	1.46	1.57
PostestDO2	71.53	318	0.00	1.74	1.69	1.79
PostestDO3	132.91	318	0.00	1.92	1.89	1.95

Research Result

This contain of overall data analysis, presentation, interpretation and explanation of the data. Tables and figures are given in order to make the data analysis clear. Outcomes are clearly interpreted. Data collected included pretest and posttest scores as mean test and t-test were performed as follows:

1. The results of the research have accepted the hypothesis with significance level.

2. The result of research found out that the water quality after the experimental was not so good and getting better after 3 days later and after 7 days has getting into normal value.

3. It mean that the treatment has not create the river pollution and not harmful to the fish and other species under the river, that can be eaten the eco bakery products and it has decomposed in naturally.

Conclusion

Eco bakery for friendly Environments in Ecological can be the optional model which has supported the sustainable development goal 2030 in action and practices.

The result of research found out the difference of water quality as BOD value of pre-test and post-test of the experimental research by using, ECO bakery as the treatment to evaluate that the treatment has not create the pollution to the river and not harm to fish and aquatic species under the river and can be decomposed in naturally.

By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans. (Rights of Nature for Peace and Sustainable Development, United Nations, Geneva, 2017)

Acknowledgements:

Limitation

1. We cannot count the fish population in the river for testing, it cannot be confirmed the number of fish population which effected and related with Eco bakery. (Sustainable Management of Water and Fish Resources in Burkina Faso, 2014).
2. The balance of DO has lower value in the big River might be effected from the boat traffic and organic compounds in water. (Oceans and the Sustainable Development Goals, 2011).
3. Time has Limited.

Future work:

1. It should be test in other material as leaf wood for comparison the result.

2. It should be test again in every year to keep data and monitoring water qualities.

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EFFECT OF VISCOSITY PARAMETER ON THE NUMERICAL SIMULATION OF REINFORCED CONCRETE DEEP BEAM BEHAVIOR

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Abstract:In the study, a parametric nonlinear finite element (FE) study is performed in order to investigate sensitivity of viscosity parameter on numerical simulation of RC deep beam behavior. For this objective; a numerical verification of an existing experimental study of a deep beam is conducted by using ABAQUS software with varied values of viscosity parameter. Results of the experimental and numerical studies are compared in terms of load-displacement behaviors, and rate of convergence and calculation time of the numerical models. Selection of an optimum viscosity parameter and its definition to FE model improves significantly performance of convergence and reduces analysis time of numerical simulations of RC deep beams.

Key words: Viscosity parameter, concrete damage plasticity, finite element analysis, ABAQUS, reinforced concrete deep beam

Introduction

It is known that behavior of a structure relies on behavior of its members such as columns, beams etc. Therefore investigation of nonlinear behavior of reinforced concrete (RC) members under static and dynamic loads is very crucial to design safe structures (Caglar et al., 2015a, 2015b)

Deep beams are defined in ACI 318-14 (2014) code as RC members that are loaded on one face and supported on the opposite face. Moreover they have a clear span not exceeding four times the overall member depth.

There are several studies demonstrating that finite element (FE) analysis including an accurate numerical modeling technique and appropriate constitutive material models is also a quite reliable and robust tool to simulate and investigate nonlinear behavior of RC members (Demir et al., 2016a). Because of this reason, FE analysis is widely preferred tool by researchers for their scientific researches (Edip et al., 2013).

Two different constitutive material models are offered in ABAQUS/Standard, which is an implicit analysis program, for the analysis of concrete at low confining pressures: the smeared crack concrete model and the concrete damaged plasticity (CDP) model. Moreover, the CDP model is based on the assumption of isotropic damage and considers the degradation of the elastic stiffness induced by plastic straining both in compression and tension. For the CDP material model it can be defined flow potential, yield surface, and viscosity parameters ("ABAQUS online documentation server").

In implicit analysis programs, constitutive models lead to severe convergence difficulties due to softening behavior and stiffness degradation of materials. The use of a viscoplastic regularization of the constitutive equations is one of common technique to overcome some of these convergence difficulties ("ABAQUS online documentation server"). For the CDP material model in ABAQUS software, viscoplastic regularization can be taken into account by defining a viscosity parameter in material definitions.

Ren et al. (2015) conducted a finite element study of PPC bridge deck panels based on validation of an experimental

test using concrete damage plasticity model. In a part of the numerical study they made a parametric analysis with varied values of viscosity parameter. Numerical results demonstrated that lower values of viscosity parameter increased calculation accuracy and increased the calculation time.

Moreover, Ma et al. (2012) studied the numerical simulation of an existing experimental study on the energy absorption columns. ABAQUS software was used to perform numerical research. The concrete damage plasticity model was adopted for the calculation of constitutive concrete material used in the columns and the viscosity coefficient was discussed. It was specified that until finding a reasonable value for viscosity parameter, a parametric study should be conducted in order to improve convergence of numerical simulation.

No default value for viscosity parameter is proposed in ABAQUS manuals and literature in which it is however highly recommended to be defined to FE models to overcome convergence difficulties in numerical simulations. Because of that reasons, the motivation of the study is to investigate sensitivity of viscosity parameter on nonlinear numerical simulation of RC deep beams. For this purpose numerical verification of an existing experimental study of a deep beam is performed by employing a commercial finite element software ABAQUS. Results of the experimental and numerical studies are compared in terms of load-displacement behaviors, and rate of convergence and time of numerical models.

Viscosity parameter (μ)

The CDP model can be regularized in ABAQUS/Standard using viscoplasticity by permitting stresses to be outside of the yield surface. Viscoplastic regularization of the constitutive equations causes the consistent tangent stiffness of the softening material to become positive for sufficiently small time increments. Generalization of the Duvaut-Lions regularization is used according to which the viscoplastic strain rate tensor, $\dot{\varepsilon}_v^{pl}$, is defined as (Eq. 1);

$$\dot{\varepsilon}_v^{pl} = \frac{1}{\mu}\left(\varepsilon^{pl} - \varepsilon_v^{pl}\right) \quad (1)$$

Where μ the viscosity parameter representing the relaxation time of the viscoplastic system, and ε^{pl} is the plastic strain evaluated in the inviscid backbone model.

Additionally, for the viscoplastic system, a viscous stiffness degradation variable, d_v, is defined as

$$\dot{d}_v = \frac{1}{\mu}(d - d_v) \quad (2)$$

Here d is the degradation variable evaluated in the inviscid backbone model. The stress-strain relation of the viscoplastic model is defined as follows;

$$\sigma = \frac{(1-d_v)D_0^{el}}{\varepsilon - \varepsilon_v^{pl}} \quad (3)$$

Taking a small value for the viscosity parameter, small adequate compared to the characteristic time increment, usually contributes to improve the rate of convergence of the model in the softening regime, without compromising numerical results. While $t/\mu \to \infty$, the solution of the viscoplastic system relaxes to that of the inviscid case, where t is time.

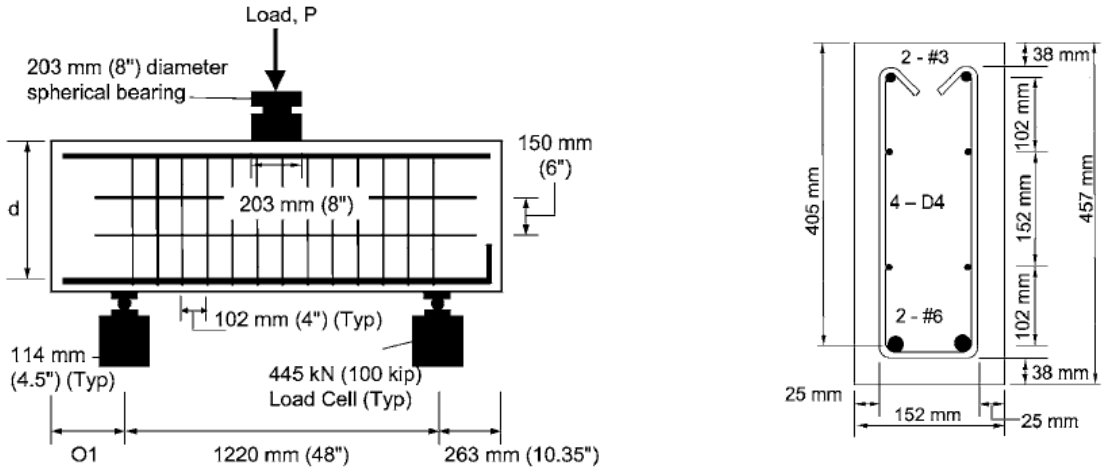
Value of the viscosity parameter can be defined as part of the concrete damaged plasticity material behavior

definition. The default value of μ is zero in ABAQUS/Standard that corresponds to omission of viscoplastic regularization. If μ differs from zero, output results of the stiffness degradation and plastic strain refer to the viscoplastic values, d_v and ε_v^{pl} respectively ("ABAQUS online documentation server").

Experimental study

An experimental study conducted by Roy and Brena (2008) are selected as a reference study in order to create a numerical model of an RC deep beam. One of the specimens named as "DB1.0-0.75L" in the reference study is chosen as a reference verification specimen. The ratio of shear zone to effective depth of the section (a/d) is given as 1.0.

The details of specimen geometry, reinforcement, and experimental test setup are displayed in Fig. 1. Additional details about test setup, loading procedure and material properties can be found in the relevant study.



a) Side view b) Cross Section

Figure 1. Specimen geometry, reinforcement, and test setup (Roy & Breña, 2008)

Load-displacement result of the test is presented in Fig. 2. Since no tabular data for load-deflection graph were given in the reference study, loads and corresponding displacement values are determined manually (Demir et al., 2016b).

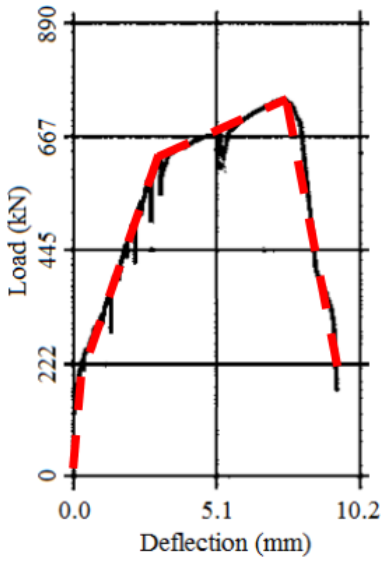


Figure 2. Load-deflection result of the test (Demir et al., 2016b)

Numerical modeling

In the study, the FE-code ABAQUS/Standard (ABAQUS/CAE 6.13-2 SE) is used to create numerical simulation. Inelastic behavior of concrete is defined to FE model by using Concrete Damaged Plasticity (CDP) model. Similar numerical FE model of a deep beam proposed in the study of Demir et al. (2016b) is used to conduct the present numerical parametric study on the viscosity parameter. Because of that reason, FE modeling procures to create current numerical simulation are not explained here and whole details can be found in the related study. Moreover FE model and verification result with test result are demonstrated in Fig. 3.

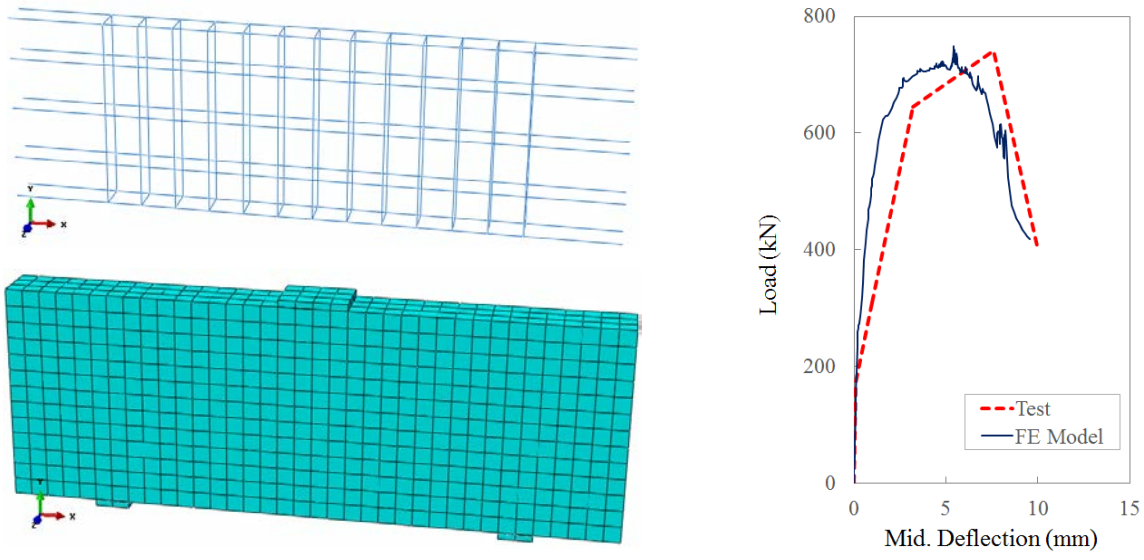


Figure 3. Meshed FE model and and verification result (Demir et al., 2016b)

Parametric study

In order to investigate effect of viscosity parameter on numerical behavior of RC deep beam, a parametric study is performed. For that objective 8 different numerical models are created with different viscosity parameter, tabulated in Table 1. Results of the experimental and numerical studies are compared in terms of load-displacement behaviors and ultimate load levels. Additionally, total number of iterations to finish the numerical analysis, percentage of convergence according to step time (taken as 1 second in the FE model), and comparison of error of numerical results with the test result in terms of ultimate load levels are tabulated.

Results and discussion

The test and numerical study results are tabulated in Table 1 and plotted in Fig. 4. Results of the total number of iterations to finish the FE analysis and percentage of convergence according to step time are specified. Moreover, ultimate load (f_u) values of the test and numerical models are given, and error of numerical results in f_u are compared with the test result in the table.

It can be clearly seen from Fig. 4 that viscosity parameter plays very important role on numerical results in a way that it changes significantly the numerical load-displacement behavior of deep beams. However load-displacement graphs could not be obtained for models DB-1 and DB-2 because the FE models did not converged. The FE model (DB-1) aborted with very small percentage of convergence (6 %) under value of viscosity parameter, zero which is a default value of ABAQUS software. Moreover with the definition of a very small viscosity parameter to the FE model, DB-2, the simulation similarly did not converged but the percentage of convergence has slightly increased (14 %). Due to nonconvergent results, duration of analysis (total number of iteration) could not be measured for that FE models.

Table 1. Results of the experimental and numerical study

#	Name of Model	μ	Total no. of iteration	Convergence %	f_u (kN)	Error % in f_u
1	DB-Test	-	-	-	740	-
2	DB-1	0	n/a	6	n/a	n/a
3	DB-2	0.00001	n/a	14	n/a	n/a
4	DB-3	0.00005	605	100	692	-6.5
5	DB-4	0.00010	508	100	697	-5.8
6	DB-5	0.00050	444	100	738	-0.3
7	DB-6	0.00100	341	100	786	6.3
8	DB-7	0.00500	305	100	929	25.5
9	DB-8	0.01000	278	100	1109	49.9

Along with the increase in value of μ, numerical models have started to converge. For the models, DB-3 and DB-4, the numerical results are very similar to the test results in terms of load-displacement behavior of the tested deep beam. Percentage of error in ultimate load level stayed under 10 % as well. Total number of iterations for DB-3 and DB-4 are 605 and 508 respectively.

With increase in value of viscosity parameter (above 0.0005), numerical load-displacement behaviors of the models of DB-5 through DB-8 have started to lose their fitness in terms of ultimate load levels. Especially when the value of μ is above 0.005, the models of DB-7 and DB-8 performed very poor behavior and the results substantially deviated from test results. However total number of iterations decreased significantly.

Conclusions

In the present study, a parametric FE study was performed in order to investigate sensitivity of viscosity parameter on numerical simulation of RC deep beam behavior. For this objective; a numerical verification of an existing experimental study of a deep beam is performed by using ABAQUS software with varied value of viscosity parameter assigned to the FE models. Results of the experimental and numerical studies are compared in terms of load-displacement behaviors, and rate of convergence and time of numerical models.

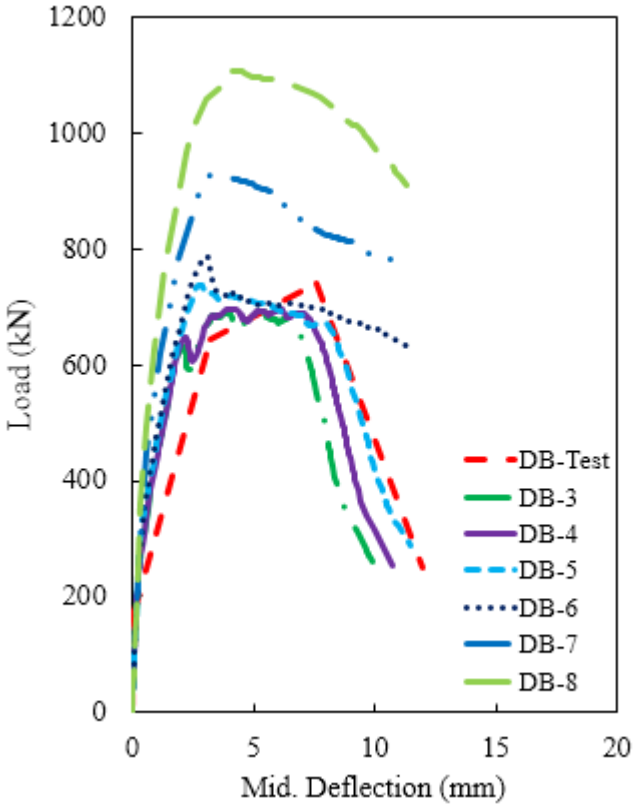


Figure 4. Load-displacement results

The numerical results are deduced that omission of viscoplastic regularization by taking the default value of μ as zero in ABAQUS generally causes nonconvergent results in FE simulations. Viscosity parameter however plays very important role on numerical simulation of RC deep beams. Along with definition of a viscosity parameter to the simulation, not only increase in convergence performance of FE model but also a significant reduce in duration of an analysis can be obtained.

For numerical simulation of RC deep beams, an optimum value for viscosity parameter in terms of numerical convergence and analysis time should be selected and assigned to the FE model. The optimum value of the parameter can be taken as 0.0005 giving very accurate numerical result in terms of load-displacement behavior. Above that value, numerical results become distant from the test results. Nevertheless, it should be noted that until finding a reasonable viscosity parameter, a parametric numerical sensitivity study should be conducted with varied values of the parameter in order to improve calculation accuracy of numerical simulation of RC deep beams.

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GREEN PROCESSES IN THE TEXTILE DYEING AND FINISHING

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Abstract: Large amount of water is utilized in the textile dyeing and finishing processes and as a result of that, the treatment of this large amount of effluent creates cost and very important environmental problems. Therefore, the "Green Production" concept is the first key issue as far as the textile wet processes are concerned. In the last two decades, new technologies have been utilized in order to minimize the processing time, energy consumption, water consumption and the amount of effluent. "Green production" is a preventive business strategy in textile dyeing and finishing industry and may include the following emerging technologies:

- use of ultrasonic energy in textile dyeing and finishing,
- use of microwave energy in textile dyeing, drying, and dye fixing,
- use of plasma technology in textile dyeing and finishing,
- use of supercritical fluids in textile dyeing and cleaning,
- use of ozone in bleaching of textiles and also in the treatment of dyeing effluents,
- use of combined enzymatic processes in the pre-treatment of textiles,
- use of the "Direct Dyebath Reuse" technology to minimize the amount of water to be used,
- reuse of recovered chemicals and dyes from processes and
- reuse of decolorized effluent in dyeing and finishing.

This current work will review the recent technology used in the textile wet processes with a particular emphasis on the work carried out in the Turkish textile industry.

Keywords: Green chemistry, Dyeing, Microwave, Ultrasound, Supercritical carbon dioxide

Introduction

Water has been an essential medium in many textile wet processes including pre-treatment, dyeing, finishing and printing. These processes use large amount of water and the effluents of these processes create very big environmental problems and cost in the textile industry as far as the treatment of the polluted water is concerned (Christie, 2007). The Water Stress Index is defined as the ratio of a country's total water withdrawal to its total renewable freshwater resources and it is a measure of the pressure exerted on water resources (Bixio, 2006). A recently published OECD (Organisation for Economic Co-operation and Development) document draws attention to the fresh water availability with a projection to the year 2050 (OECD, 2012). Therefore, in the last two decades, new strategies were put in use and the research has been done to minimize the amount of process water, the amount of chemicals used, the process time and the energy consumed for each process (EC, 2003). In order to that, the following strategies, under the name of "Green Production", are employed:

- use of ultrasonic energy in textile dyeing and finishing,
- use of microwave energy in textile dyeing, drying, and dye fixing,
- use of plasma technology in textile dyeing and finishing,
- use of supercritical fluids in textile dyeing and cleaning,
- use of ozone in bleaching of textiles and also in the treatment of dyeing effluents,
- use of combined enzymatic processes in the pre-treatment of textiles,
- use of the "Direct Dyebath Reuse" technology to minimize the amount of water to be used,
- reuse of recovered chemicals and dyes from processes and
- reuse of decolorized effluent in dyeing and finishing.

"Green production" is a preventive business strategy in textile dyeing and finishing industry and nowadays, more research is carried out on these topics.

Use of Ultrasonic Energy in Textile Dyeing and Finishing

Ultrasonic waves lie between 20 kHz and 500 MHz frequencies. The chemical power of ultrasound comes from the *cavitation* phenomena and the cavitation occurs as the micro bubbles in water when a negative pressure applies to it. In the collusion of these bubbles, a large amount of energy exists. The use of ultrasonic energy decreases the process time and the required energy for the process. Ultrasonic energy is used in textile processes for pre-treatment (desizing, bleaching and scouring), dyeing and textile finishing processes (Öner, 2009; Yachmenev

(2007); Basto, 2007). In the textile sector, a pilot size dyeing machine which was equipped with ultrasonic transducers was constructed and used in dyeing of textile materials (Perincek, 2009); however, no commercial size dyeing machine is yet available.

Use of Microwave Energy in Textile Dyeing, Drying and Dye Fixing

In the electromagnetic spectrum, the microwaves (MW) are in the range between radio and infrared waves. The microwave region of the electromagnetic spectrum corresponds to wavelengths of 1 cm to 1m (30 GHz to 300 MHz) and only the frequencies 2.45 GHz (12.2 cm) and 900 MHz (33.3 cm) are available for dielectric heating. The microwave applicators used for chemical purposes generally operate at 2.45 GHz (12.2 cm) (Tierney, 2005). It has been reported that the dyeing processes have been enhanced by MW heating and the dyeing rates have been increased (Öner, 2013; Haggag, 1995; Berns, 1979; Kim, 2003; Haghi, 2004; Buyukakinci, 2005; Nourmohammadian, 2008; Yoshimura, 2009; Ohe, 2009; Montazer, 2007). Microwave energy improves the dyeability of flax fibre with reactive dyes (Sun, 2005). Microwave energy is also used for dye fixing and drying in textile processes. More research goes on the construction of commercial size microwave treatment machine to be used in textile processes.

Use of Plasma Technology in Textile Dyeing and Finishing

Plasma technology is one of the environmentally friendly techniques. The enormous advantage of plasma processes concerns the drastic reduction in pollutants and a corresponding cost reduction for effluent treatment (Morent, 2008). Atmospheric pressure plasmas (typically corona plasmas) are used for the ease of generation of gas-phase radicals which react with and modify the polymer surface (Shishoo, 2007). Particularly, the plasma treatment is useful for the polymers which cannot be dyed easily by the conventional methods, e.g. exhaustion or impregnation (Park, 2001; Shahidi, 2007).

Use of Supercritical Fluids in Textile Dyeing and Cleaning

Carbon dioxide has a low critical point (74 bar and 31°C) and it can be used in many applications in industry. As a super critical fluid, it is a very good solvent for hydrophobic materials. Carbon dioxide is a cheap, inert, non-combustible, non-toxic and easily available chemical. There are several reviews in the literature to summarize the use of super critical carbon dioxide in textile processes (Derbent, 2015; Banchero, 2013; Banchero, 2008; Liao, 2012;). Textile fibres containing polyester (Cardozo-Filho, 2015; Giorgi, 2000; Van Der Kraan, 2007; Zheng, 2015), acrylic (Jun, 2005; Zheng, 2017), polyamide (Elmaaty, 2015; Liao, 2000;), wool (Güzel, 2000), Nomex (Kim, 2006), ramie (Liu, 2000), cotton (Fernandez Cid, 2007; Schmidt, 2003) and the blend of polyester/cotton (Maeda, 2004) can be successfully dyed by the supercritical carbon dioxide. It can also be used in the textile cleaning and the finishing processes (Rombaldoni, 2009). A very recently, a Dutch company, DyeCoo has introduced a beam dyeing machine which uses the super critical carbon dioxide technology (DyeCoo, 2017).

Use of Combined Enzymatic Processes in the Pre-Treatment of Textiles

The possibilities of enzymatic processes have been discussed in detail in the literature (Cavaco-Paulo, 2003). It has been suggested that using various types of enzymes, namely amylase, protease, lipase, pectinase, laccase, glucose oxidase, catalase and cellulase, from the beginning to the end of the preparatory processes of textile substrates could be achieved (Quandt, 2000). The combined enzymatic processes of textile materials were also achieved by several researchers (Öner, 2011; Aly, 2010; Hebeish, 2009; Kokol, 2004; Tanapongpipat, 2008; Tzanov, 2001). The use of enzymes enhances the process efficiency, shortens the process time and requires the use of less energy, compared to the conventional methods which are carried out separately. In the Turkish textile companies, the enzymes, namely amylase, pectinase and catalase are widely used in the preparatory processes.

Reuse of Recovered Chemicals and Dyes from Processes

Dyes and various chemicals can be recovered from the effluents of the processes and these are very valuable. For example, there are several techniques which are used to separate the caustic soda from industrial wastewater, namely neutralization, filtration process, leaching, evaporation, and electrodialysis (ED). In one recent sturdy, caustic soda was recovered from industrial wastewater by two-stage diffusion dialysis (DD) and electrodialysis (ED) processes (Imran, 2017). Also, the recovering and reuse of sodium hydroxide by evaporation is very beneficial as reported in a recent work (Topgül, 2017). A 4-stage evaporator was used to recover NaOH from the mercerization effluent containing 11.8°Bé weak caustic. The total benefit of the system was almost 178 USD/h per 1 ton of fabric (Topgül, 2017). Textile dyes, particularly indigo dye from the denim plant' effluents are successfully recovered and reused for the next process (Wambuguh, 2008; Amaral, 2014).

Use of Ozone in Bleaching of Textiles and also in the Treatment of Dyeing Effluents
Ozone is a very powerful oxidant and the bleaching of cellulosic fabrics by a process containing ozone efficiently is possible (Prabaharan 2001; Arooj 2013). Ozone is also used to decolorize the dyeing effluents. Around 90% reduction of the incoming COD and BOD was reduced effectively (Carriere, 1993; Colindres, 2010; Constapel, 2009; Günes, 2012; Takahashi) .

Conclusion

Water is an essential chemical for the dyeing and finishing industry. However, the prevention at source can be achieved by the use of new technologies, the reuse and the recycling of water. The minimization of water usage in the textile wet processes can be accomplished by putting one or more technologies mentioned above. From the most desirable to less desirable, the hierarchy of pollution control measures are listed below (Christie, 2007):

- Prevention
- Reduction
- Reuse
- Recovery
- Recycling
- Energy recovery
- Disposal

No doubt that the super critical carbon dioxide as a solvent in textile dyeing and finishing will substitute water in near future, since there is no effluent discharged to the environment after the process and more research on this technology is going on. Also, the reuse of spent dyebath, particularly in disperse dyeing of polyester is widely practised in the industry. Prevention is always better than cure and the right strategy can save money, reduce pollution, reduce waste disposal and effluent discharge, and improve product quality.

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INVESTIGATION FOR NECESSARY INEQUALITIES FOR THE TURNABILITY OF THE DRIVING SHAFTS OF A PLANAR MECHANISM

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Abstract: This study focuses on the turnability analysis of MMD (Multi Motion Drive) Machine, in general, of a planar parallel 3-RRR robot with three synchronously driven cranks. There are simple geometric characterizations for both by coplanar carrier lines of the arms or additionally by particular coplanar parallels. Finally, some inequalities investigated, which are necessary conditions for the turnability of the driving shafts.

Keywords: Planar mechanism, completely turnability, singularity of constrained motion, simulation of movement

Introduction

A kind of such mechanism were first introduced and analyzed by Can (2012) and Can & Stachel (2014) and by Can (2015). These are high-speed planar mechanisms with modifiable compulsory courses based on parallel robots simultaneously driven cranks. It was with Software Packages ***Maple*** demonstrated by Can & Canay (2016) that the question whether the cranks of a given mechanism are completely revolvable cannot be answered in terms of dimensions of the mechanism. The problem can only be cleared from case to case by a numerical analysis. Here a particular diagram is very useful which also indicates reverse poses as well as bifurcations of the constrained motions.

In the following, it is given definition and graphical methods for the geometrical construction and design of the mechanism:

Definition

The basic principle involved in Multi Motion Drive (MMD) Technology consists of a synchronized vertical and horizontal movement, which results in a virtually elliptical needle tip path. Below is a needle punching machine of the company Dr. E. Fehrer, Linz/Austria (Figure 1).

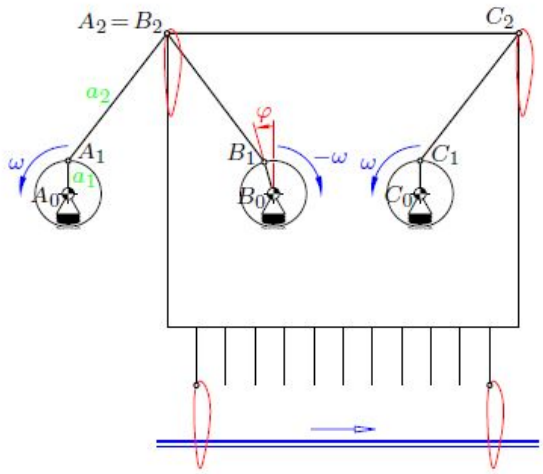
Figure 1. Needle punching machine as a MMD

Consequently, the needles no longer stop the felt during penetration, thus creating excellent web quality. MMD also permits the infinite adjustment of horizontal advance even while needling is in progress. This MMD could be displayed as graphical as follows: Figure 2a shows below an indirect mechanism where the moving triangle is replaced by a line segment.

The motion is a curvilinear translation. In Figure 2b we see how the variation of the phase shift $\delta_b = \pi + \varphi$ acts on the trajectories. For $\varphi = 0$ all trajectories are aligned. The underlying dimensions are

$$\overline{A_0B_0} = 140\ mm$$
$$\overline{A_0A_1} = \overline{B_0B_1} = \overline{C_0C_1} = 22.5\ mm$$
$$\overline{A_1A_2} = \overline{B_1B_2} = \overline{C_1C_2} = 110\ mm$$

a)



b)

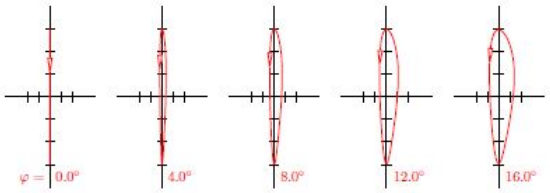


Figure 2. a) One of schematic design of MMD. b) The displayed variation on the trajectories

Demonstration of the Motion

After all analysis and synthesis in general form such planar mechanisms (see Figure 3), were exact investigated by Can (2012) and Can & Stachel (2014), below are given with SAM 6.1 Software Package demonstrated examples in Figure 4a, 4b and 4c, how the path curve shown by the motion of different chosen any desired mechanisms especially on C_2.

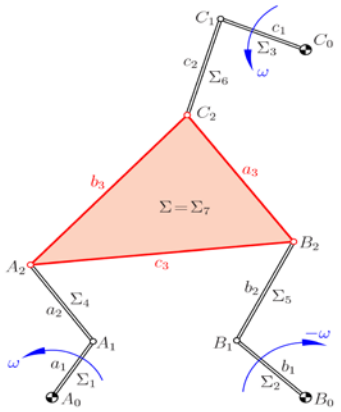


Figure 3. A planar parallel indirect mechanism

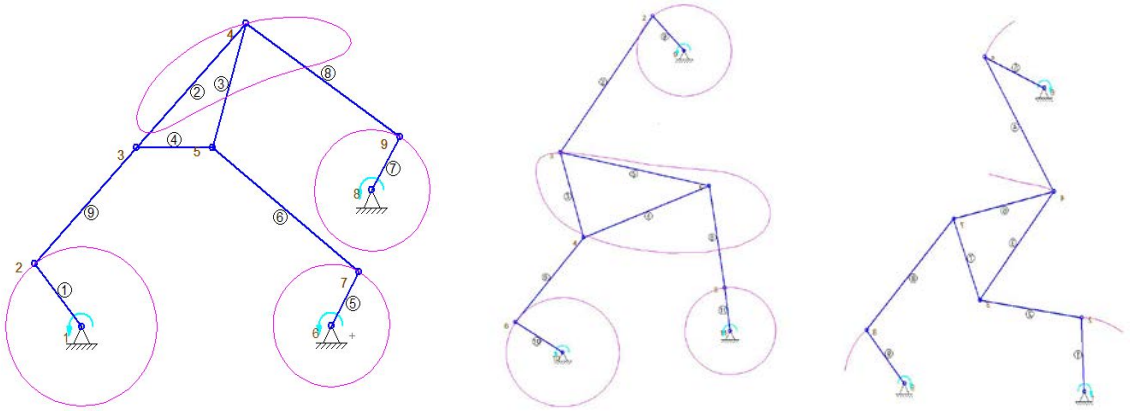


Figure 4 a), b) and c). Three examples which are demonstrated with SAM6.1

Here is graphical solutions and algebric solution for turnability such mechanisms, which is discussed by Can (2012, 2015).

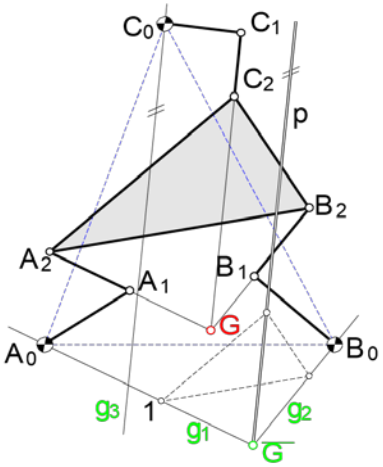


Figure 5. Singularity on the mechanism causes reverse motion

Graphical Solutions

- **Reverse Motion (Singularity)**

A pose (see Figure 5) obtained by the mechanism is ***singular*** $\Longleftrightarrow$ the lines A_1A_2, B_1B_2 and C_1C_2 are concurrent.

The position ($p \parallel g_3$) only at $\omega = 0$ movable $\Longleftrightarrow$ ***reverse motion***.

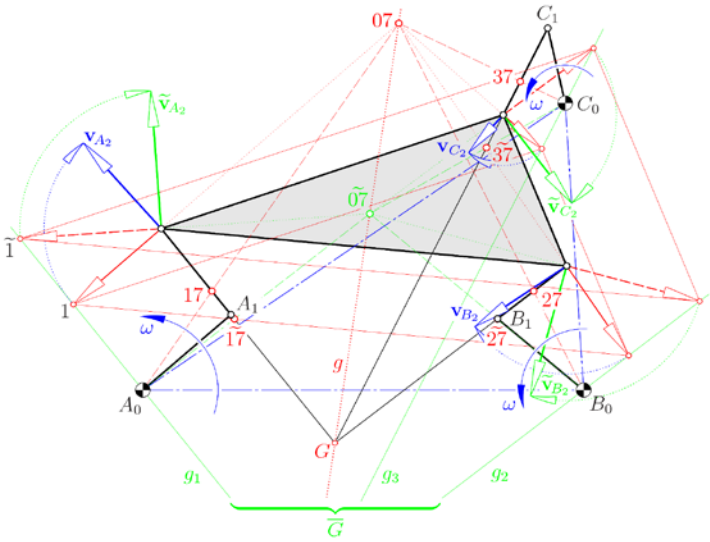


Figure 6. Two-fold singularity on the mechanism causes branch point

- **Branching (Two-fold singularity)**

Such a pose (see Figure 6) is even ***twofold singular*** $\Leftarrow\Rightarrow$
the respective parallels g_1, g_2 and g_3 are concurrent with the common point $\bar{G}$,
the lines A_1A_2, B_1B_2 and C_1C_2 are concurrent with the common point G ($p = g_3$, ***branching***).

- **Standstill**

A pose (see Figure 7) has a standstill $\Leftarrow\Rightarrow$ $A_1A_2 \cap B_1B_2 \cap C_1C_2 = \emptyset$ and $A_0A_1A_2$, $B_0B_1B_2$, $C_0C_1C_2$ collinear.

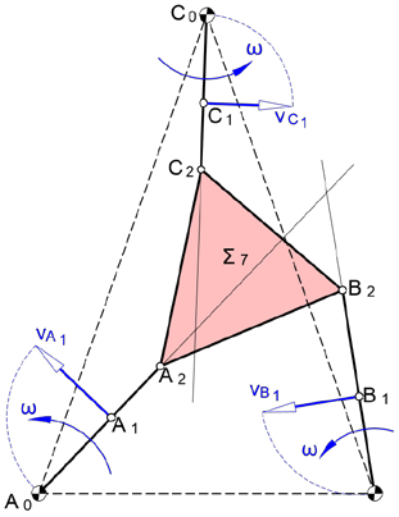


Figure 7. Standstill position

Turnability of the Driving Shafts

There are necessary conditions for the turnability of the driving shafts:
The distance $\overline{A_1B_1}$ between the endpoints of the cranks A_0A_1, B_0B_1 must not exceed the sum of distances $\overline{A_1A_2}$, $\overline{A_2B_2}$ and $\overline{B_1B_2}$, i.e.,

$$max\{\overline{A_1B_1}\} \leq a_2 + b_2 + c_3.$$

On the other hand, the inequality

$$min\{\overline{A_1B_1}\} \leq c_3 - a_2 - b_2$$

must be satisfied, which of course is trivial under $c_3 < a_2 + b_2$. By the way, because of equal angular velocities of the cranks, for extreme distances $\overline{A_1B_1}$ (see Figure 8) it is necessary that

- in the case of direct mechanism the connecting line A_1B_1 is parallel to A_0B_0;
- in the indirect case the line A_1B_1 must pass through the midpoint of A_0 and B_0.

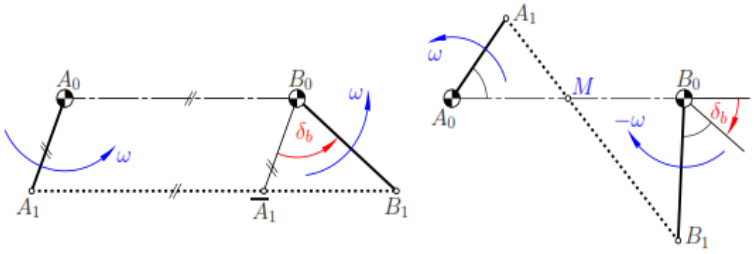


Figure 8. Positions with extreme distances $\overline{A_1B_1}$ for direct and indirect case

For the mechanisms can be expressed with the following theorem in terms of the dimensions a_0, b_0, …, b_3, c_3, δ_b, δ_c and guarantees that the active bars A_0A_1, … are fully turnable.

Theorem 1. Generally, the following inequalities are necessary conditions for a fully turnability of direct case of such kind mechanism:

$$min\{|c_3 - a_2 - b_2|, |c_3 + a_2 - b_2|, |c_3 - a_2 + b_2|\} \le \left|c_0 - \sqrt{a_1^2 + b_1^2 - 2a_1b_1cos\delta_b}\right|;$$

$$c_0 + \sqrt{a_1^2 + b_1^2 - 2a_1b_1cos\delta_b} \le a_2 + b_2 + c_3,$$

$$min\{|a_3 - b_2 - c_2|, |a_3 + b_2 - c_2|, |a_3 - b_2 + c_2|\} \le \left|a_0 - \sqrt{b_1^2 + c_1^2 - 2b_1c_1cos(\delta_c - \delta_b)}\right|;$$

$$a_0 + \sqrt{b_1^2 + c_1^2 - 2b_1c_1cos(\delta_c - \delta_b)} \le a_2 + b_2 + c_3,$$

$$min\{|b_3 - c_2 - a_2|, |b_3 + c_2 - a_2|, |b_3 - c_2 + a_2|\} \le \left|b_0 - \sqrt{a_1^2 + c_1^2 - 2a_1c_1cos\delta_c}\right|;$$

$$b_0 + \sqrt{a_1^2 + c_1^2 - 2a_1c_1cos\delta_c} \le a_2 + b_2 + c_3 \blacksquare$$

On the other hand, the numerical solutions with *Maple* of mechanism produces two real solutions sets in interval t =[0, 360^0] which demonstrated in Figure 9. There are to be observed that common points both of the solution sets mean branching position, vertical tangents mean reverse motion position of the mechanism.

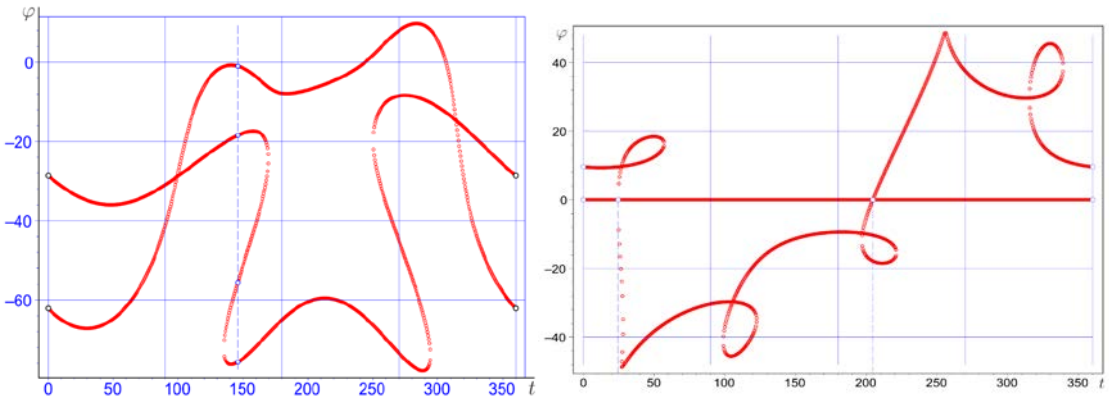


Figure 9. Common points: branching; Vertical tangents: reverse motion, Horizontal line: standstill

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INVESTIGATION OF BURSA, ESKIKARAAGAC USING VERTICAL ELECTRICAL SOUNDING METHOD

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Abstract: The aim of this research is to study the ground resistivity of a region located at Bursa, Eskikaraağaç village by using vertical electrical resistivity (VES) method which is one of the geoelectrical methods. For that purpose, two Wenner arrays were applied on the ground. The measured VES data is analyzed via software named RES2DINV. The program gives layer thicknesses and real resistivity values on two dimensional underground resistivity sections. Interpretations on the possible locations of water can also be made. These interpretations can later be verified by drilling groundwater wells.

Keywords: Vertical Electrical Sounding, RES2DINV, Wenner array

Introduction

Today, climate change leads to shortage of water while the demand from limited resources increases with population. Drilling is unknowingly used for the purpose of searching and finding water. Whereas, geoelectrical methods provides some information about aquifer layers and water existence before drilling. Geoelectrical methods are the most common methods in exploration geophysics. The method, which makes use of the resistivity feature of earth, is used in search for underground assets such as water, geothermal energy, minerals and petrol.

In this study, geophysics resistivity measurements have been conducted on a previously chosen field over the aquifer at Eskikaraağaç village. Resistivity measurement was taken using Wenner arrays. Two pieces of Wenner arrays were made in total. A program called RES2DINV (Loke, 2000) was used in the evaluation of these measurements. Consequently, real resistivity values and thicknesses of geological layers were obtained and mapped in two dimensions. By considering real resistivity values and the two-dimensional map, inference about water existence was made.

Geoelectrical Methods

Basically, geoelectrical methods are implemented in three different ways. These are Self Potential (SP), Induced Polarization (IP) and Vertical Electrical Sounding (VES). Vertical electrical sounding method is based on the principle of measuring the potential difference formed by electric current delivered to the ground by two current electrodes. The aim of this method is to determine the depth and resistivity of underground layers by using surface potential measurements. VES method has different geometrical arrays depending on the problem on the ground. The most common used arrays are Schlumberger, Wenner and Dipol-Dipol. Basic differences between arrays are investigation depth and horizontal solution accuracy. Comparing Wenner and Schlumberger; both electrode arrays have the same current transmission horizontally, however, investigation depth is more in Schlumberger method. For the same opening width, accuracy of measurement is much better in Wenner array. According to these comparisons; generally, Wenner is preferred for shallow studies. As to Schlumberger, it can be used both shallow and deep research (Başokur, 2004). In Figure 1, A and B are current, M and N are potential electrodes in a Wenner array. In practice, electrode current is emitted from two points like A and B and then potential difference is measured from separate two points like M and N.

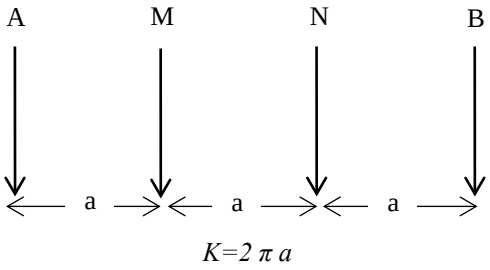

Figure 1. Wenner array

After calculating the geometric factor (K), apparent resistivity is calculated with Eq. 1.

$$\rho = \left(\frac{\Delta V}{I}\right) K \qquad (1)$$

ρ= Apparent resistivity (ohm-m)

ΔV= Voltage (mV)

I= Current (mA)

K= Geometric factor

Essentially, earth consists of complex structures rather than isotropic semi-infinite media. Because of this reason, resistivity relationships do not give real ground resistivity values. Resistivity value obtained with current given into the ground and obtained using several equations is named as apparent resistivity. Apparent resistivity is equivalent to real resistivity in case of isotropic semi-infinite media (Başokur, 2004). To obtain real resistivity of layers and thickness of layers graphical methods are used. Generally, on a logarithmic paper, apparent resistivity value is placed on vertical axis and electrode spacing on horizontal axis and several methods are used to obtain value of real resistivity and thickness of layers. These methods are given below;

a. Successive approximation methods

b. Asymptotic estimate

c. Rough estimate methods

d. Estimate with model curves

d.1. Estimate with double layer model curves

d.2. Estimate with three layer model curves

d.3. Estimate with assistance point cards

e. Direct comment methods

While Successive approximation methods have been the least used methods, Asymptotic estimate were the most used methods until computers improved (Coşkun, 2005). Programs, such as IPI2WIN (Bobachow, 2002), RES2DINV (Loke, 1997) are widely used today.

Field Study

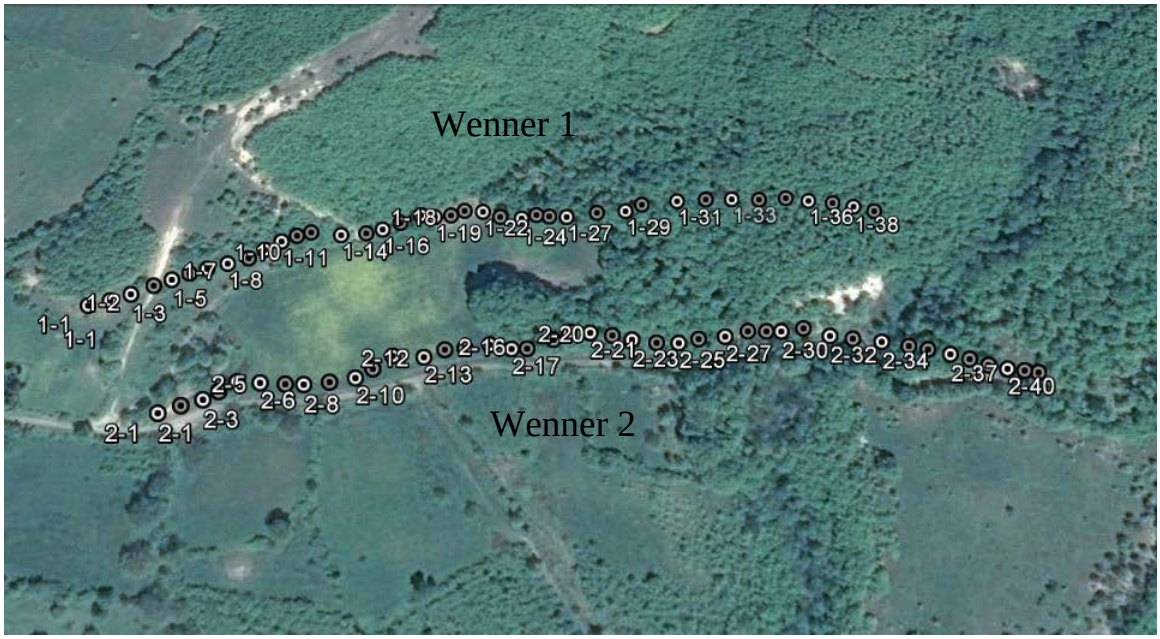

Figure 2. Measuring points

Wenner arrays (Multiple-electrode resistivity method) is implemented in two profiles (Figures 2-3-4). 39 electrodes were used, electrode spacing was selected as 10 meters. Totally, 380 meters of opening is made for Wenner 1. 42 electrodes were used, electrode spacing was selected as 10 meters. Totally, 410 meters of opening is made for Wenner 2.

Figure 3. Wenner 1

Figure 4. Wenner 2

RES2DINV's Results

After records taken from multichannel resistivity device were transferred to a computer in DAT format, they were evaluated by RES2DINV program for the two Wenner arrays (Figure 5 and Figure 6). In the evaluation, real resistivity, layer thicknesses and also possible well location were obtained. Formations are indicated in Figure 5 and Figure 6. Alluvial formations are available in different regions in Figure 5, Figure 6. For this reasons possible well location is chosen at x=85 m along Wenner 1 array.

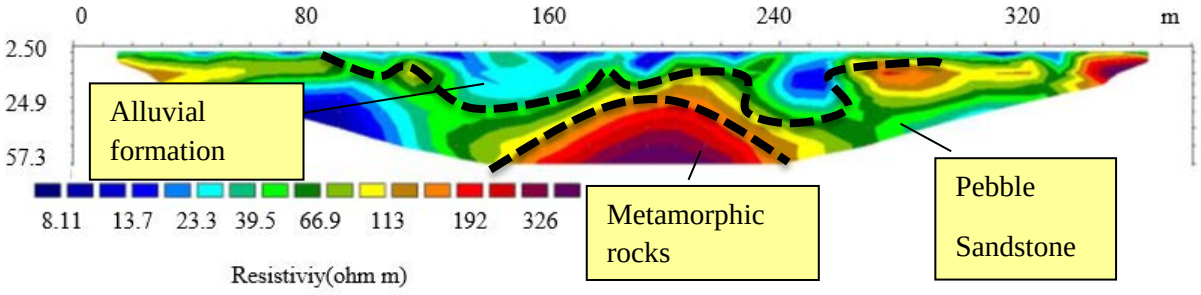

Figure 5. RES2DINV's results for Wenner 1 array

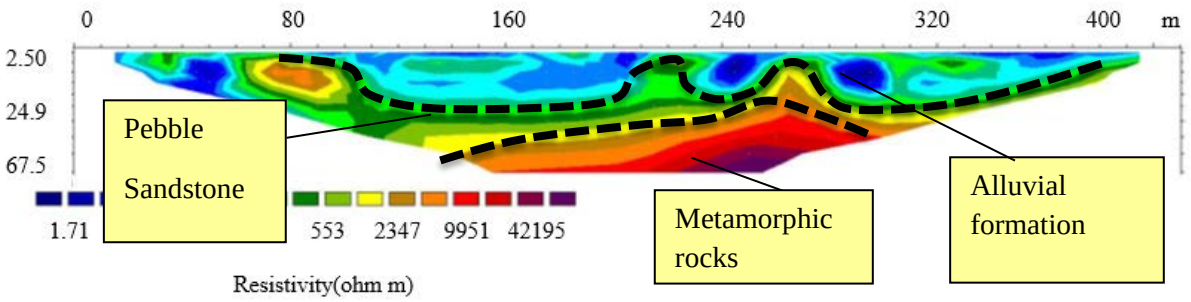

Figure 6. RES2DINV's results for Wenner 2 array

Conclusion

Considering the two-dimensional maps in Figure 5 and Figure 6, when resistivity values are small, water containing formations are thought to be available. If the location is indicated with blue color, it may be alluvial formation. If the location is indicated with yellow or green colors, it may be pebble, sandstone. Dark red unit is considered to be the metamorphic rocks.

By referring to the two-dimensional maps, comments can be made about the location of the well to be drilled. While determining the location of a well, it is necessary to consider drilling method and formation. The suggested well location in this study lies along Wenner 1 line at around x=85 m which is located away from alluvial formations. Mud rotary drilling method is preferred for suggested well. The reason for this method is that it is more economical than others.

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INVESTIGATION ON VIBRATION ANALYSIS OF THE EFFECT OF FIBER BREAKS IN UNIDIRECTIONAL COMPOSITES

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Abstract: In this study, strength losses due to fiber breaks in unidirectional cantilever beam composites were investigated by vibration analysis. The fibers in a continuous Fiber Reinforced Plastic (FRP) composites have the largest percentage of FRP composites determined. Particularly the number of fibers in the continuous fiber used significantly affects the strength of the FRP composite produced. Because the continuous fiber used can be damaged during production or in composite manufacturing. For this reason, in this study, strength losses due to fiber breaks in FRP cantilever beam composites are investigated by mechanical vibration analysis. Finite element analysis (FEA) model is used for fiber breaks in composites. Damaged Fibers that transfer mechanical loads completely to the resin cause the loss of strength in FRP composites.

Keywords: Composite, FRP, Continuous Fiber, breaking, damage, vibration, FEA

Introduction

Composite materials have a wide range of applications because they have low density and high strength values. The areas of use of composite materials are frequently used in industrial and defense industries such as space, ship, commercial and passenger cars. Fiber reinforced composites (FRP) are important in composite materials. FRP composite materials are formed by combining the matrix and the fibers. The fibers carry the load and provide rigidity, while the matrix transmits the load to the fibers. Although these properties of composite materials are appreciated, they also tend to have defects that cause significant structural damage to the integrity of these materials. The mechanical properties of FRP materials depend on the type of fiber used. For this reason, any errors in the fiber can change the strength properties of the composite material. It is used as a sensor in carbon fiber composite materials having a fragile and conductive structure. Due to this feature, it has been observed that the electrical conductivity changes due to the fracture of the continuous carbon fibers in the composite structure (Chen & Liu, 2008; Wang & Chung, 1996; Wen, Xia, & Choy, 2011; Xia & Curtin, 2008). It has also been experimentally demonstrated that continuous carbon fibers are damaged by filament winding method by about 43% due to pretension applied to the fiber during production. (Genç & Akkus, 2017).

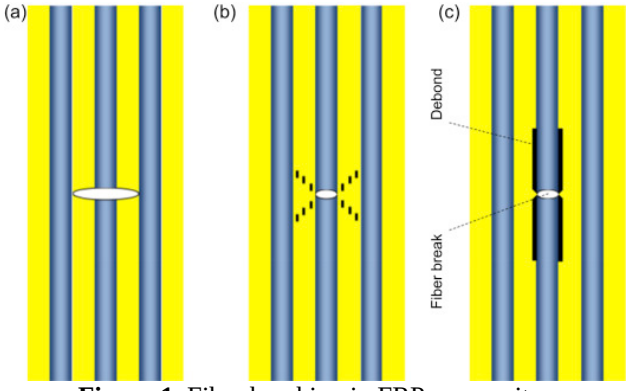

Figure 1. Fiber breaking in FRP composites

Fiber damage to FRP materials during production is important as the structure changes its mechanical properties. Because the fiber used to determine the mechanical properties of FRP materials has very great role. Especially in continuous fiber reinforced composites (CFRP), If some of the filaments in the fiber are breaking off during the production, the loads on the broken fiber are transferred to the resin (Fig.1). Thus, due to the resin having less mechanical properties, loss of strength occurs in that region of the composite. In this study, the effects of filaments breakage in the FRP composites were investigated by numerical analysis. Vibration modes have been studied on GFRP composites produced by one-way glass fiber by performing dynamic research in this study.

Materials and Methods

In FRP composite materials, it is important to reveal the loss of strength due to filaments breakage in fiber For this reason, 30x10x300 mm cantilever beam was used to investigate the effect of fiber breakage in FRP composite structures (Fig.2). In order to better understand the strength effect of fiber breakage, fibers are modeled unidirectionally in FRP composite cantilever beam. The mechanical properties of the cantilever beam due to fiber breakage will be investigated by FEA (Finite Element Analysis).

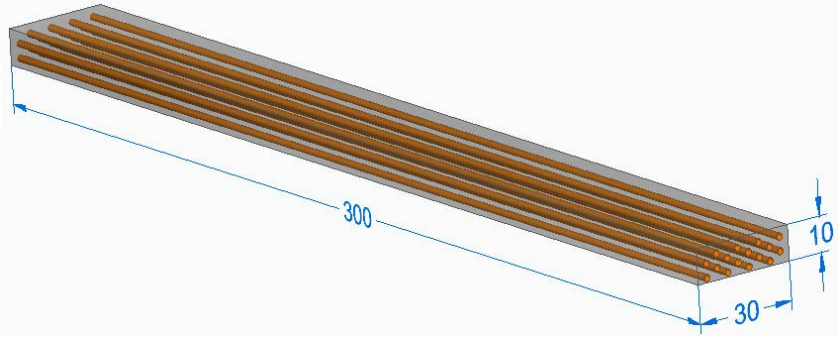

Figure 2. GFRP cantilever beam dimensions and 3D model of fiber orientation.

a) Material Model

In fiber reinforced composites, the mechanical properties of the composite vary depending on the type of fiber used, direction and mixture ratio because the fibers exhibit high strength and rigidity properties in the long axis direction. In such materials, the mechanical properties of the fiber direction (direction 1) are different from the mechanical values of the fiber direction 2 and 3 directions (Fig 3). For this reason, FRP composites are orthotropic material models (Huang, 2009; Sendikası, 09.01.2013).

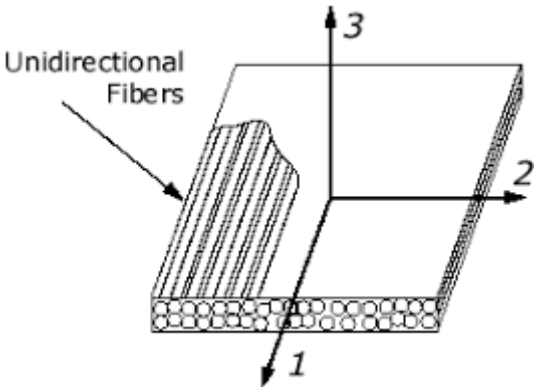

Figure 3. Orthotropic material model of FRP composites

In the composite material model, the cantilever beam are modeled epoxy and glass fiber reinforced, and the mechanical properties of the materials are given in Table 1. GFRP composites are modeled on a 60% glass fiber and 40% epoxy mixture ratio.

Table 1: Mechanical properties of materials used in composites.

Material	Properties	Symbol	Value
Glass Fiber	Elasticity Modulus	E_1^f	76 GPa
	Density	d^f	2,56 g/cm^3
	Poisson's ratio	$\upsilon_{12}{}^f$	0,22
Epoxy Resin	Elasticity Modulus	E^m	4 GPa
	Density	d^m	1,3 g/cm^3
	Poisson's ratio	υ^m	0,4

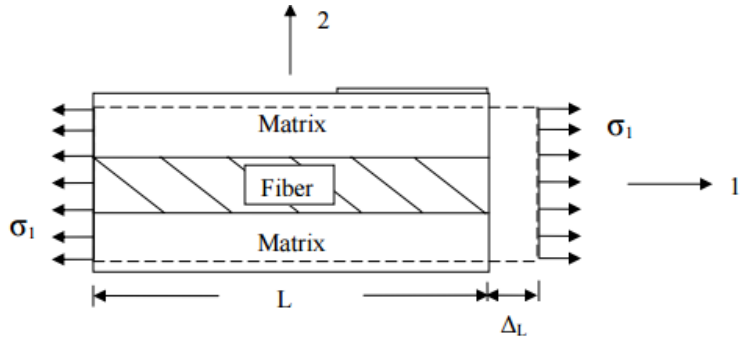

Figure 4. Unit volume element loaded in 1 direction (Facca, Kortschot, & Yan, 2006).

Composite mixture ratio was used in determining the mechanical properties of GFRP composite materials. Accordingly, as shown in Figure 4, it is necessary to determine the constants of the fiber-reinforced composite materials in the macrostructure. The mechanical properties of such materials vary depending on the rate of incorporation of the fiber and matrix in the unit cell. The mechanical properties are determined by Equation 2.1-2.3 using the fiber volume ratio (V^f) and matrix volume ratio (V^m) in the unit cell.

$$V^f + V^m = 1$$

$$E_1 = E^m V^m + E_1^f V^f$$

$$\upsilon_{12} = V^m \upsilon^m + V^f \upsilon^f$$

Material properties of the CFRP cantilever beam according to the glass fiber mixture ratio of 60% are as given in Table 2. This obtained data is valid if there is no break in the glass fibers in the cantilever beam.

Table 2. Material properties of undamaged GFRP composite

V^f	V^m	E_1^f GPa	E^m GPa	${\upsilon_{12}}^f$	υ^m	d^f g/cm^3	d^m g/cm^3	E_1 GPa	υ_{12}	d g/cm^3
0,6	0,4	76	4	0,22	0,4	2,56	1,3	47,2	0,292	2,056

b) FEA Analysis

The NX / Nastran Advanced Simulation program was used for FEA analysis of GFRP composite material. In the FEA model, CQUAD4 four node element type in 2D shell mesh were used. And this model consists of a total of 90 elements and 124 nodes. The results of the modal analysis of the GFRP cantilever beam are given in Table 3 and the mode shapes are shown in Figure 5.

Table 3. Vibration results of GFRP cantilever beam

Mod 1 (Hz)	**85,98**
Mod 2 (Hz)	**530,54**
Mod 3 (Hz)	**1451,47**
Mod 4 (Hz)	**2755,14**

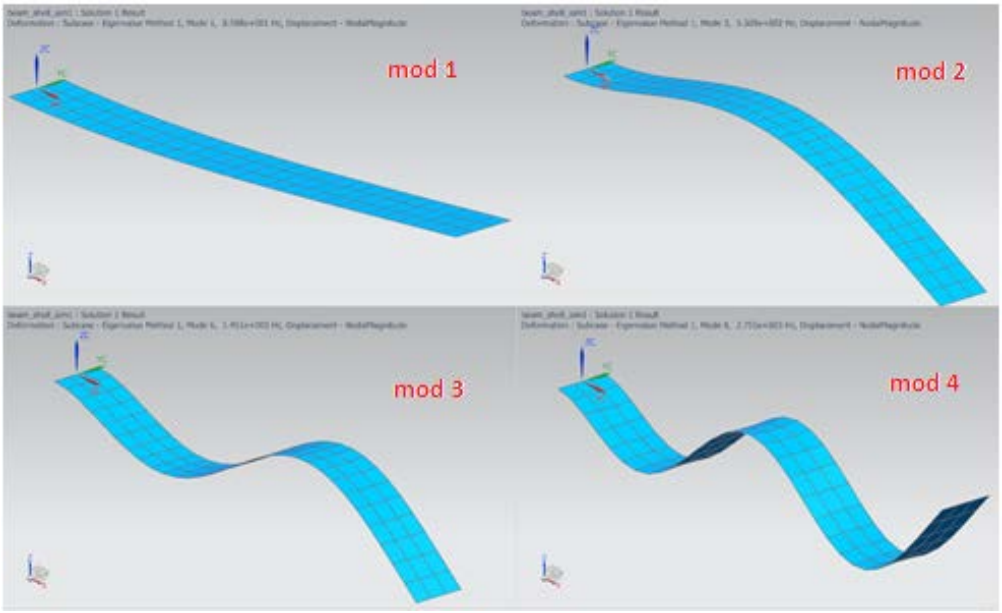

Figure 5. Mode shapes of GFRP cantilever beam

c) Vibration analysis based on Fiber Breaking

Since the fibers have a fragile structure, the fibers are of great importance in terms of the strength performance of the composite product. In FRP composites,It is accepted that the fibers do not carry the load in the regions where the fiber breakage occurs and all the load in that region carries the resin (Takehana, Akkus, Hidaka, & Kawahara, 1998). For this reason, damage to the fiber in GFRP composite materials affects the strength of the composite structure (Figure 6).

Figure 6. Model of the structure of damaged and undamaged fibers in FRP composites

Vibration analysis was performed to see the effect of fiber breaks in FEA analysis by modeling GFRP composites unidirectional. Vibration analyzes were performed to see the effect of fiber breaks on unidirectional modeled GFRP composites in FEA analysis. If the fibers in the composite beam are broken, the material properties of the beam change due to the variation of the mixture ratio in the cross section (Equation 2.1-2.3). Therefore, the modulus of elasticity of the composite varies depending on the mixture ratio as in Equation 2.2 (Figure 7). And also, the natural frequency values of the GFRP cantilever beam vibration analysis are given in Table 4 for four modes.

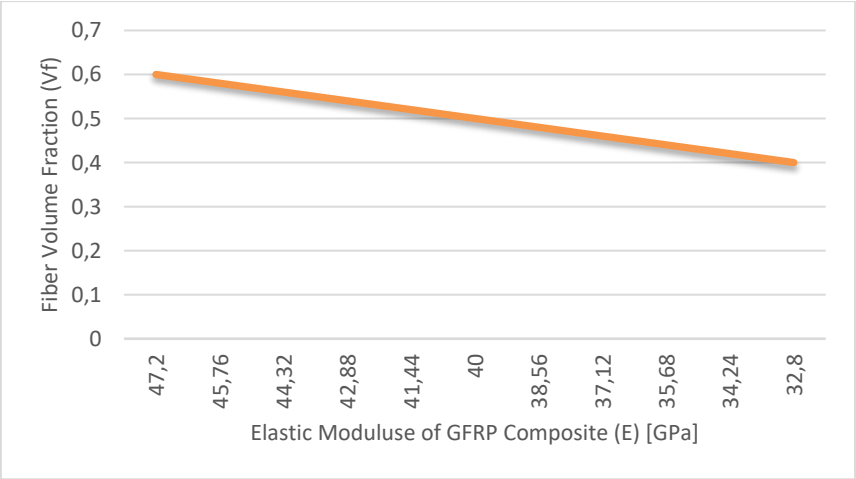

Figure 7. Change in elastic modulus of composite depending on fiber breakage.

Table 4. Vibration Analysis Results of Damaged GFRP Composite

Vf	Vm	E_1	Mod 1	Mod 2	Mod 3	Mod 4
		GPa	Hz	Hz	Hz	Hz
0,6	0,4	47,2	85,99	538,93	1509,17	2957,44
0,54	0,46	42,88	81,96	513,68	1438,45	2818,85
0,5	0,5	40	79,16	496,13	1389,31	2722,54
0,44	0,56	35,68	74,76	468,57	1312,14	2571,33
0,4	0,6	32,8	71,68	449,26	1258,07	2465,37

Results and Discussion

The effect of fiber breaks on vibration analysis on GFRP cantilever beam was investigated. In the analysis, the damaged and undamaged states of the fibers were compared. In the study, it was assumed that the fibers were damaged according to the falling ratio of the fibers contained in the composite. In this case, vibration analysis was performed by changing the damage ratio of the glass fiber in the beam by the mixture ratio. This change was analyzed according to each mode value as shown in Fig 8. According to the result of approximately 30% reduction of fiber-to-fiber mixture ratio, while the elastic modulus of the composite decreases by 30%, the natural frequency values of the beam decrease by around 17%.

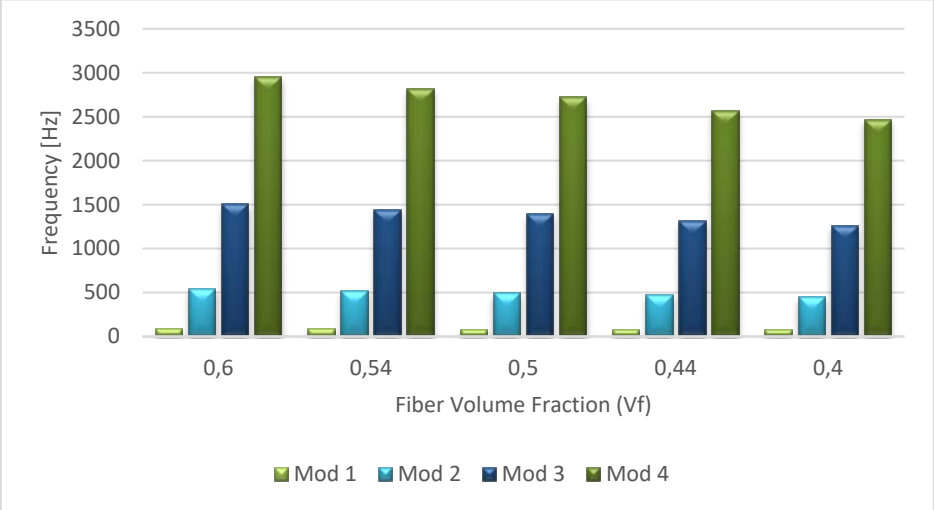

Figure 8. Vibration results due to fiber break in GFRP composites.

Conclusion

GFRP composite materials are widely used in today's industrial world. The strength performances of these materials vary depending on the type of fiber used and the amount of fiber. Due to the fracture of the fibers in the GFRP composites, the FEA analysis showed that the fibers exhibited loss of strength by not carrying the load in the regions where they existed. Because broken glass fibers transfer the load to the resin in the damaged area. For this reason, the breakage of fibers in fiber during production of FRP composites decreases the strength by affecting the produced product. This can lead to more serious problems for fiber types with more fragile structure such as carbon fiber.

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PHYSICS' TEACHERS CONCEPTION ABOUT THE DEVELOPMENT OF THE MATTER CONCEPT DURING HISTORY

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Abstract: In this article, we use a qualitative research method to reconstruct and analyze the representations of college physics teachers from Quebec in Canada on the concept of matter. We do this based on clinical interviews. This study shows that college teachers construct false representations since they often rely on naive epistemology.

Introduction

Many studies have focused on students' conceptual representation (from high school to university) on core concepts of physics (Hewson, 1982; Bagheri-Crosson and Venturini, 2006; Métioui and Levasseur, 2011). This research demonstrates that despite multi-year education many students have conceptual difficulties in solving non-canonical problems and moreover rely on false theories similar to the ones developed during history such as the theory of impetus in the case of the study of movement (Viennot, 2014). The present research follows this perspective and identifies the representations that college physics teachers from Quebec in Canada harbor on the concept of matter. It should be noted that theories on this concept constitute essential elements of knowledge in science curricula (from high school to university). In the first part, we will present a historical outline defining the conceptions that scientists make on the subject, from Greek antiquity until today, which will enable us to construct our protocol of interviews that we will use in the second part. Finally, we will describe the population studied and the general conclusions of our study.

HISTORICAL OVERVIEW OF THE CONCEPT OF MATTER

The history of science shows us that knowledge of the concept of matter was not scientific from the beginning. People were confronted with the idea of the matter by asking the question: where do the things that we see around us come from? For example, the Greeks have devised explanatory schemes based on the existence of particles of atoms that are eternal, stable and cannot break. For the philosophers, Leucippus and Democritus, we can translate all that exists from emptiness and moving atoms. Taking the ideas of his predecessors, Epicurus postulated that things are composed of fundamental "atoms" that unite or separate themselves, obeying natural laws (Thuillier, 1981).

The idea of elementary corpuscles rests on different theories. For example, Descartes (1596-1650) did not think that the elementary corpuscles were eternal. On the other hand, Newton (1643-1727) supposes them to be stable while admitting the action at a distance between masses, which has never been accepted by the Cartesians who considered actions between bodies were the result of collisions between them. But against this mechanistic trend, some scientists oppose an energy vision.

For the physicist Boscovich (1711-1787), atoms were not small balls, but rather mathematical points as centers of forces, a theoretical approach to the notion of the atom. For him, the prime elements of matter were entirely indivisible, and they were scattered in an immense void.

According to Thuillier (1981), the ideas of Boscovich were taken up again in the nineteenth century and this would have oriented the scientists towards the notion of energy instead of the notion of matter in the classical sense.

We already know from the discoveries of physicists Thomson, Rutherford, Bohr and others that an atom contains electrons located around a nucleus, itself composed of protons and neutrons. Similarly, it is known that the electron is bound to the nucleus by electromagnetic forces. On the other hand, in the nucleus, protons and neutrons are linked by a strong interaction force.

This historical reminder was intended to indicate the main stages in the development of the concept of matter. The richness of the models, as well as their conceptual and technical complexity, have not been entirely elucidated, but we can already think to a research whose results will allow the analysis of the discourse of physics teachers.

THE CONSTRUCTION OF THE INTERVIEW PROTOCOL

To uncover the representations of the teachers, we opted for a form of interview where we could interrogate the subjects directly. We present here the two questions selected for the interviews, as well as the reasons for these choices: (1) What matter is for you? And (2) Is there an ultimate constituent of matter?

According to the considerations of the first part, we can conclude, with the development of modern physics, that the concept of matter deviates more and more from the discourse maintained by scientists of the precedent era. This deviation has reached the point where scientists no longer speak of matter in the classical sense, but rather consider in term of the concept of energy since the advent of relativistic mechanics and quantum mechanics.

Our aim is to verify whether teachers are aware of the vague and ambiguous nature of this notion, contrary to the concept of energy that predicts accurate information about a given system (Wolter et al., 2002).

In quantum mechanics, the concept of energy gives information about the possibility of having an interaction between the states of a given system thanks to the equation "$H.\psi = E.\psi$". Similarly, within the framework of classical mechanics, this concept makes it possible to know the possibility of having "work" done on a given system using the equation $T + V = E$ (energy) where T is the kinetic energy of the system and V is its potential.

However, these concepts are not in logical continuity, in the sense of the historians of science Kuhn (1972) and Bachelard (1981), because, in classically mechanics, energy is defined along a trajectory, unlike Quantum mechanics where it describes a problem with eigenvalues.

As for the second question about the existence of an ultimate constituent of matter, we wanted to know if teachers were aware that scientists are no longer looking for an ultimate component that would be the basis of our material universe. On this subject, note that with the development of particle physics we know that matter is composed of two types of particles: leptons and quarks. Four types of fundamental interactions cause these elementary particles to interact.

The gravitational and electromagnetic forces at the macroscopic scale are well known; on the other hand, weak interactions and strong interactions are only observed at the nuclear level. This set of particles and interactions could, in principle, account for the entire hierarchy of the structures of matter, from atomic nuclei to stars and galaxies.

Note that nowadays, researchers are trying to find a single class of particles instead of the two ones above. Moreover, they also think that a single force could account for all the interactions between the elementary particles.

Method and Population

To identify the representations made by the teachers about matter, we conducted ten semi-directive interviews, each lasting about twenty minutes, on the above questions. The teachers' comments have been reproduced verbatim.

Each teacher has been identified with the symbol C_i (the ith teacher). Below is an analysis of the interviews conducted with ten teachers who participated in this research on a voluntary basis, nine of whom held a bachelor's degree (physics, chemistry, mechanical engineering and electrical engineering) and one held a master's degree in Physics (M.Sc.).

INTERPRETATION OF THE DATA OBTAINED IN THE TEACHERS' SPEECHES IN RELATION TO THE FIRST QUESTION

Concerning question 1, most teachers consider matter as a juxtaposition of atoms. It would be a concrete concept that can be apprehended by appealing to the senses. For example, subjects C_7 and C_8 have used "sensory" representations to define the matter. Here are the terms in which C_8 clarified his point of view about this concept:

“That is what makes the solid object on which one sits [...]. For me, matter is what one perceives daily, and that is what makes one exist [...] matter, that's it. It's solid; I touch it. For me, it's real.” (C_7)
“That's all that surrounds us. Whether it is solid or gas or liquid, that is what I would call matter. That is what one can touch, that one can feel.” (C_8)

Thus, this teacher has a naive conception of matter and grants a great confidence to his senses. In our view, this is a realistic approach that differs from the modern approach.

Subjects C_6 and C_{10} have specified in their answers that matter is made up of atoms. Thus, for these persons, the matter would be an assemblage of atoms. Here is how they clarified this idea:

“We can define matter from the atom, as we can define it from our environment. So, we can start from matter, so it's what surrounds us, to try to define what is the constituent of matter or even to go, to do the reverse. To say the matter is a collection of atoms which constitutes what surrounds us.” (C_6)
“Matter and a set consisting of this raw material, in fact, which is the atom.” (C_{10})

These two teachers have a naive representation, as they spontaneously trust the evidence of the first experience. It is the same for the teacher (C_3) who considers the matter as:

“All these particles (proton, ion, ...) there that form a rigid whole, a set if one wants [...]. A particle is a part of the matter.” (C_3)

The explanations given by these teachers (C_3, C_6, and C_{10}) lead us to think that for them, the matter seems to be reduced to a set of combinations of atoms and that it is composed of fundamental particles, small elementary bodies. Moreover, none has insisted on the vagueness of the notion of matter.

However, two of the ten teachers interviewed (C_2 and C_9) attempted to define matter by referring to the energy concept but failed to provide a coherent explanation and asserted in their answers their difficulty in identifying the epistemological premises that underlie the concept of energy since they specify:

“It is energy ... it is what underlies all the transformations, all the revolutions, all the chemical physics reactions, all to, and then it is, of course, at the origin of life too ... but what it is, I do not know ... I think I prefer to say that I am not sure exactly.” (C_2)
“It can be an assembly of these particles of atoms. If I consider it as a wave, I will say that it is energy, while being aware that energy is a notion that we understand very badly.” (C_9)

For subjects C_2 and C_9, energy is a notion that is not well understood. In our view, on the contrary, it is a concept whose postulates are clearly established, as much in quantum mechanics as in classical mechanics. Indeed, in classical mechanics, one defines the energy of a physical system in motion as the scalar product of the resulting force exerted on the latter and its displacement. In quantum mechanics, energy is the solution of the equation with eigenvalues: $H.\psi = E.\psi$.

The answer given by the subject C_1 does not differ from those provided by the teachers C_3, C_6, and C_{10}. The latter, however, called for a quantitative assessment of the matter. For him, matter is a “quantity of the substance; this substance can be composed of several core elements.” Moreover, the explanations given by the subject C_3 resembles those of the subject C_1, since according to him:

“Matter is a set of fundamental constituents arranged in different ways which cause the paper I have in front of me to be paper [...]. The matter is ultimately an assortment of primary constituents called protons, neutrons, and electrons, which are arranged in different ways in order and quantity, so that carbon, nickel is obtained.” (C_5)

For this teacher, the matter seems reduced to a set of small elements since for him, the particles “are fundamental constituents which, from these elements, we reconstitute all the matter that we have around us.” In our opinion, C_5 emphasizes the concept of a particle and does not seem to have grasped its high level of abstraction.

Finally, the subject C_4 explicates in his speech that everything that exists, in reality, is explained from the emptiness and the atoms. Indeed, in his words:

"Matter is all that surrounds us [...]. Matter for me essentially is made up of void. But within this void, there are grains [...]. The material consists of this grain, called the atom." (C_4)

The above definition approaches the materialist thesis of the Greek thinkers Leucippus and Democritus that the origin of all things can be explained by primordial material elements (emptiness and atoms).

INTERPRETATION OF THE DATA CONTAINED IN TEACHERS' SPEECHES IN RELATION TO THE SECOND QUESTION

Regarding the question of the existence of an ultimate constituent of matter, none of the ten teachers interviewed stated in his speech that researchers are no longer looking for a final constituent of matter, as has been the case for several generations and that the actual research done in particle physics aims to understand the different types of interactions that govern the particles.

Subjects C_1, C_2, and C_{10} were not able to answer because they do not have a clear opinion on this issue. Moreover, teachers, C_4 and C_8 seem to assert in their speeches that the atom is the ultimate constituent of matter. For example, C_4 specifies that the atom is the fundamental element of matter:

"There is not one (the constituent of matter), there exists that whole which is at the basis of everything. We cannot say that the electron is the ultimate basis of matter, I cannot say that the proton is either. It is because I believe that in the matter, they are always encountered in the presence ... ultimately the ultimate basis is the atom which is the essential foundation." (C_4)

In our view, the explanations given by this person about the matter and the existence of its ultimate constituent resemble those provided by the Greeks. Indeed, for him, matter is an assemblage of atoms, that is to say, of fundamental particles which are infinitely small.

The subject C_8 has specified in his speech that he prefers to speak not of the ultimate constituent, but of ultimate unity. Below is how C_8 explain his idea:

"The atom is a whole with what's in it like electrons, protons, all that. We cannot say that the electron is ultimate or that the proton is ultimate, the whole makes the atom. So far, ultimately, I would say the principal unit, it is the atom." (C_8)

According to these remarks, C_8 seems to reason again at the level of the principal unit of matter which exists in the material world, a reasoning that no longer accords with the developments of modern science.

The answers given by C_5 and C_7 do not deviate implicitly from the answers given by C_4 and C8, namely a substantiate conception of matter. For example, C5 states that "possibly a fundamental constituent of matter will be found."

For him, particles are essential constituents of matter that "they are primary parts which, from these elements, we reconstitute all the matter that we have around us."

Moreover, C_7 does not seem to be aware of the preoccupations of particle physics, because "if in the universe one meets the atom of hydrogen, one also meets the free electrons and the protons and the nuclei. The universe is done the same way, I teach astronomy, astrophysics and then I do not see any problems more that." In this representation, C_7 seems to concretize the concepts of the electron, proton, etc.

The teachers C_6 and C_9 referred to the notion of quark to interpret their answers:

"The current studies on the quark suggest that everything would build from that. Namely, we will find something else, smaller? Well, it is even imaginable. Easily believable." (C6)
"If we rely on the historical evolution of knowledge, we may presume that when we have isolated the three quarks, we will decompose them into other parts." (C_9)

The above comments lead us to believe that teachers C_6 and C_9 attach great importance to the problem of decomposition and show confidence in the existence of matter at the subatomic level.

Conclusion

From the preceding considerations, one can conclude that physics teachers have retained relatively naive representations about matter. Indeed, we have clarified that the explanations they provided follow the perspective of a philosophy of visual and sensorial inspiration. For most of them, matter consists of an assembly of particles. A result from a process of decomposition of matter. With such representations, one can understand why none of the respondents consider that the concept of matter becomes more and more abstract in the discourse of physicists, to the point where physicists prefer the idea of energy.

The results of this research on teachers' representations show that there is a need to rethink teacher training, if not to integrate into their training elements of history and epistemology of sciences (Niaz, 2002; Métioui et al., 2016). However, it is important to emphasize that it is at this condition that they will have the opportunity to reflect on their knowledge, to ask questions that lead to an awareness of the postulates that guide the construction of knowledge and generate conceptual change possibilities (Posner et al., 1982; Zhou, 2010).

For example, how can we induce an epistemological change in the teacher that will allow him to reflect on the epistemological breaks in the development of the concept of matter? Given the complexity of this question, we will just enumerate some answers to show that our research could allow the development of a strategy to facilitate teachers' assimilation of the concept of matter.

The first step is to make teachers think about the importance of the social dimension of science. A reflection begun in this direction will allow them to consider science as a human activity where the search for reality and truth occupies only a small place (Abd-El-Khalick and Lederman, 2000; Adúriz-Bravo, 2007).

The second step is to analyze the successive models developed during the development of theories on the composition of matter. In this stage, teachers will be asked to clarify the epistemological premises that underlie the different doctrines developed on the subject, while confronting them with their conceptions. According to this path, theories on the matter no longer appear to the teachers as the result of a serie of continuous improvements whose aim is the search for the ultimate constituent of matter.

Finally, it should be emphasized that such a teaching strategy will make it possible to see the conceptual difficulties encountered, for example, by scientists Thomson, Bohr and Rutherford, to name just a few, to develop their atomic models (Niaz et al., 2002; Métioui and Trudel, 2015).

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PLANNING IN HIGHER EDUCATION THE FUTURE OF THE FACULTY OF STATISTICS AND INFORMATICS, UNIVERSIDAD VERACRUZANA, MEXICO

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ABSTRACT: A planning exercise was carried out at the Veracruzana University, named after the state of Veracruz, where it is located. The Faculty of Statistics and Informatics of the University was, due to internal distancing among staff, on the verge of dissolution into two separate entities, where neither one would be able to retain faculty status. An intervention was programmed to explore the possibility that the members of the Faculty come up with a unified vision of the institution and thus prevent dissolution. The planning exercise selected was the Reflection and Design Conference (RDC), which is an adaptation of the Search Conference (SC) methodology to the Mexican organizational culture. After an initial period of uncertainty due to conflicting positions of some members of the faculty, a unified and consensual desired future was achieved, and projects were designed upon diverse lines of action with the full participation of faculty members, authorities and students. The intervention proved successful in that members were able to set a path for the Faculty that allowed it to maintain its status. The paper presents a brief summary of the RDC methodology, the process of implementation, and the results achieved by members of the Faculty, with the hope of contributing to the discussion on planning in educational institutional settings.

Keywords: Planning, participative, Reflection and Design Conference, Search Conference

Introduction

The present experience is inserted within processes of profound organizational change, where there is need to remove obstacles to the formulation of effective development plans.

It is natural that power groups form around diverse interests in organizations. They can be legitimate interests, like academic interests, political, social, including union interests if the objective is to improve conditions of its members. However, at some point these interests can come into conflict with the organization and provoke a certain paralysis. The point in time when this occurred in the case of the Faculty of Statistics and Informatics (FEI) of the Universidad Veracruzana (UV, Veracruzan University) was the institutional requirement on the Faculty to elaborate an Institutional Development Plan in order to be allocated funds from the university treasury.

At the Faculty[1] in question there were opposing interests that were retarding the formulation of their Development Plan. An influential academic in the Faculty, with strong leadership and following in the Statistics group, had a different agenda. He would agree to the Institutional Development Plan only if it provided for the separation of Statistics from Informatics, an institutional transformation that could not be accepted by University authorities.

Through a pre-intervention briefing, the attempt was made to convince the academic community of the need to air their differences in an environment of respect and equality, with the aid of outside consultants that would play the role of facilitators of the process. A way to mobilize the academic community around a plan and at the same time trigger an academic renovation that would provoke the creativity and boldness of the staff, the consultants proposed, was the conduction of a Reflection and Design Conference (RDC) (Jiménez, 1987; Jiménez *et al.*, 1997 a, b; Jiménez, 2001), an adaptation of the Search Conference (SC) methodology developed in Tavistock, England. The Conference is an excellent tool that allows groups to converge on common objectives. At the heart of the process lies the socialization among all stakeholders of a common problem, where conflicting interests are

[1] The usage of "Faculty" in this paper refers to the disciplinary and administrative distribution that stems from the higher education system that originated in Europe, as opposed to faculty, meaning academic or professorial "staff", in the British and US departmental systems of higher education. Somewhat equivalents in the latter are the "college", or the "school".

invariably exposed, and in the name of a common good, expunged. In fact, the influential academic leader at subsequent meetings, joined colleagues and fully participated in task group work.

The outcome of the Conference was the formulation of 11 specific projects that constitute the main part of the Development Plan. It was agreed that the Faculty's change process would be followed-up with subsequent meetings. At the time, there have been two of such meetings that evidence that various projects have advanced in the attainment of their goals.

The paper will present a brief theoretical and methodological background of the RDC, describe the process of its implementation at the FEI, and the positive results obtained. It is worth noting that during the second follow-up meeting, the academic that had previously rejected the realization of the RDC joined the group, as his intention was to lead the group that would formulate the Development Plan. At the end of the second meeting, the community practically demanded that the head of the Faculty form a work team to elaborate the plan, and the discontented academic agreed to participate in the process.

The results obtained up to now in this intervention are very positive. It shows us the efficacy of the RDC insomuch as once it is realized, a follow-up takes place of the subsequent change process, that will allow the members of the community the opportunity to evaluate the progress of their own projects, of providing feedback amongst colleagues in the different work groups, of knowing the opinion of external observers, all in an environment of absolute respect and equality, encouraged by the facilitators.

Theoretical aspects of the intervention method: The Reflection and Design Conference

The method utilized in the event is named Reflection and Design Conference. This resource provides the conditions necessary for a fruitful convergence among organizational systems whose interactions are weak. The method is based on the *Search Conference (SC)*, proposed by Fred Emery and Eric Trist in 1958-59 (Emery M., 1993, 1994).

Among types of interventions (Blake and Mouton, 1976), the Search Conference shares the essence of the *confrontational* approach described by these authors. It is an approach that challenges the *status quo*, and asserts that the future can be built by the members of a system. The Search Conference accepts that the individual is able to learn and experiment by himself the processes of participative, strategic planning that will lead the system toward a desired future, designed by the participants.

The Search Conference was conceived as an alternative to planning efforts that had had scarce impact. It is centered on a participative philosophy of planning. Its focus coincides with the assumption that centralized planning, promoted from "the top", inhibits the creativity of the people involved, that is, of those that are responsible for carrying out actions, and reduces their level of commitment and identification with drawn plans: "…the Search Conference works adequately in the generation of commitments and therefore improves the possibilities of implementation." (Crombie, 1984, p.2).

The Search Conference is a useful instrument especially in turbulent environments such as those in which organizations are currently immersed (Emery, F. and Trist, 1965; Schon, 1971; Ackoff, 1974; Emery, M., 1994), as when it is conducted, planning takes place in a viable and adaptive way "…it provides a "social" space where reflection and design can take place in an environment free of self-imposed restrictions" (Jiménez, 1987, p. 1).

In their effort to import the virtues of a method of this nature, the strategic planning research group at the Department of Mathematical Modeling of Social Systems of the Institute for Research in Applied Mathematics and Systems, after experimenting on a number of occasions, saw the need to effect some adaptations at an operating level to the original method of the SC, to be applied successfully in the Mexican organizational context. Out of this effort, emerges the Reflection and Design Conference, a modality of the SC that preserves the basic principles that make it a robust group method (Rodríguez, 1998), of which the following are the most important:

- Provide a platform so that the processes of reflection and design can take place with the most liberty possible, and in a spatial-temporal mosaic as broad as considered by participants.

- Guarantee a broad participation of the involved in a complex problematic situation, creating a democratic environment.

- Encourage an environment of trust and respect so that people, which attend as individuals and not as representatives of the groups they belong to, put forth their opinions even when these are antagonistic.
- Encourage both the design of desirable futures as well as the joint effort for their achievement.
- Promote the social learning that will increase the ability to self-organize, adapt and plan.

The RDC emphasizes the importance of the two principal moments of the method: the **reflection** on the problematic and the **design** of courses of action to overcome it. It is a procedure that propitiates the adequate conditions to propose solutions to complex problems, where the participation of those involved constitutes a fundamental element. It is based on the premise that the future can be modified by the intervention of those interested. There is no single future, there are various possible. The name of the game consists of achieving one that is desired and agreed by all.

It takes advantage both of the experience and the knowledge of the participants to enrich with their creative ideas the formulation of action in the short, medium and long terms. In addition, it facilitates a coming together among members of different sectors, creating an environment of collaboration. It allows participants to complement their vision with that of others, achieving an understanding of the problematic in a different way, generating new options, and creating the possibility of greater cohesion among them.

The RDC structures group work, stimulates participation, organizes the generation of creative ideas, and facilitates the convergence toward the realization of concrete actions and the establishment of commitments oriented toward a common ideal. The method has the delicate but necessary purpose of opening new paths and stimulating creativity without usurping the role of the members' respective organizations. These types of events are designed to provoke substantial changes, thus their effects are appreciated in the mid and long term. They are not conceived as isolated events, but as the beginning of a continuous effort of periodic evaluation-modification of the course of action agreed upon.

In synthesis, the method implies the task of jointly designing the desired future and needed actions to reach it, instead of being passively "overrun" by a future that is to be avoided.

It is a horizontal event. All participants' opinions have the same value. As group work consists in the building of a desired future and the means to reach it, no one is able to consider himself "expert" in those tasks.

With the aim of having participants feel free to expand their field of alternatives, they attend the event as individuals interested in overcoming the problematique in question, not as representatives of the organizations where they work.

The facilitators of the Conference do not intervene in the generation of the "substance". Their role is to help propitiate an environment of trust, learning, mutual respect and collaboration, and ensure that the rules established in the work dynamic are observed.

Methodology

The RDC consists of five stages (See Figure 1). In the first, participants explore in depth the contextual conditions under which the system has functioned in the past, how it performs in the present, and how it will perform in the future if nothing is done to modify the current situation. In the second stage, attendants reflect upon the manner in which the system performs in the present, and how it has arrived at such a situation. The third stage consists of an exercise in creative design. Participants work, free of self-imposed restrictions, in the bold design of the system's ideal future, within a time frame of 5 to 10 years. The idea is to configurate a system that responds to the needs and desires of all involved. In the fourth stage, participants return to the present and reflect on current and future obstacles and opportunities that obstaculize or facilitate the attainment of the future defined in the previous stage. In the fifth stage, participants propose courses of action to approximate the desired future and, depending on their degree of involvement, in a final sixth stage, they commit to work on those courses identified as of high priority.

Participants are organized in groups of 10 to 12 persons each which will work in parallel during the first four stages, holding plenary sessions at the end of each stage, to share their points of view. In the fifth stage new groups are formed according to each participant's personal interest, to work on the design of a priority course of action. At the end of this stage, a plenary session is held where the specific designs developed by the new

groups are presented. Each one of the initial groups is aided by a process facilitator, whose role is to ensure that the rules of the method are observed rigorously.

As only the attendants participate in the elaboration of the content of the topics, they experience full authorship of the ideas and assume total responsibility over them. Since the results belong to all, it is probable that they establish commitments toward them, and elaborate on activities that will lead to drawn objectives.

The RDC is a method immersed in a process of intervention; in consequence it requires careful pre-planning and post-implementation of the courses of action drawn. To omit this point is to provoke deceit and frustration among participants.

An RDC requires previous preparation and careful planning, since it is not an isolated event. Generally, it produces conditions for change that needs preparation, and sets the ground for the starting-off of processes of improvement in the long-term.

To take advantage of the impulse that this type of events provides to change processes, it is necessary to count on the participation and support of authorities from beginning to end. It is only so that the achievements obtained can be capitalized on to confront and channel change.

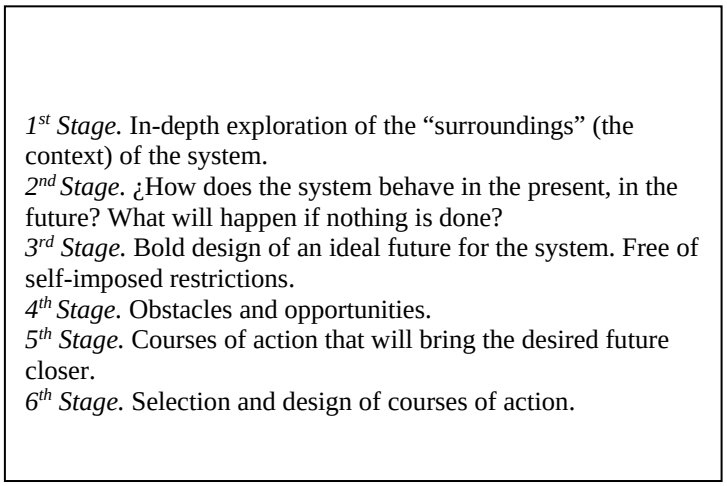

Figure 1. Stages of an RDC.

Need to follow-up on the RDC

The RDC is designed to provide members of a planning community the basic elements to liberate themselves from self-imposed restrictions, overcome current obstacles that seem insuperable and detect opportunities that had until then gone unnoticed. It is an exercise that, through a correct management, allows the community itself to plan its own future and establish procedures and mechanisms to reach it. The result of the RDC is not a plan designed by consultants, it is an exercise conducted by the community itself with the aid of a group of facilitators. As Merrilyn Emery (1994) asserts, its objective is not the plan in itself, but the creation of the ***planning community***. In the past, this maxim had been followed with rigor. No subsequent follow-up was implemented by the consultant. The consulting team acted exclusively as facilitator of a process of dialogue whose end was to plan the future, and retired once the community had designed its plan, which took place in a period of 2 to 3 days of intense collective work. If there was some "follow-up", this took place only informally, with no established commitment. The RDC, as the SC (Emery, 1994), is a process immersed in another that is broader that includes preparatory planning, the event itself, and the implementation of the resulting plans. The planning community must know from the start, that the presence of the facilitator ends with the RDC's conclusions. In the moment that this occurs, the planning community must continue the process on its own, following the assumption that the community learned to plan and implement formulated plans.

However, in the Mexican organizational environment, throughout the years the research group at IIMAS, as was said before, has felt the need to adapt the SC method, designed in the developed world and thought for its own idiosyncrasy, to certain aspects that are unique to local culture. Thus the change that took place even in the name of the method itself, which now reflects more truthfully local sentiments: a process of deep **reflection**, first, followed by a **design** stage. **Conference** denotes lecture, and **search** tends to be associated more to some

esoteric activity that has scarce relation to the most immediate environment of "developing" countries. In addition, the Conference has undergone other changes that have to do with a more immediate reality of the local environment. The most recent innovating proposal, still in a testing stage, revolves around the need to monitor the evolution of the planning community that emerges with the completion of the RDC, through follow-up visits throughout a period of two years, and spaced between themselves by periods of three to four months.

The intervention: The "warming up" process

The formulation of the School's Development Plan was being confronted with obstacles to its elaboration. A group of the teaching staff was opposed to the fact that the Plan was led by the head of the Faculty, and wanted to have control over its implementation. On the other hand, it was imperative that such a Plan was carried out by virtue of the fact that the support by the University's presidency was granted based on such a plan in each academic unit.

The Faculty's administrative body made contact with the IIMAS, knowing that the group utilizes regularly the RDC to start-off participative strategic planning processes, with the aim of having the group disseminate the method throughout the university community via a meeting with professors and students. The attendance to the meeting was a bit scarce due to a degree of rejection to the administration's initiative. However, the procedure raised interest among those attending.

In order to familiarize a greater number of academics with the concept of the RDC, a new presentation was programmed. The intention was convince the academic body that the realization of a RDC would be beneficial as a prior step to the formulation of a Development Plan. On this occasion, the format of the presentation was changed, and it was turned into a dialogue among colleagues in search of alternatives for the advancement of the Faculty. The attendance was much more numerous than on the prior meeting, and at the end of the presentation it was agreed to carry out the RDC almost unanimously.

Part of the problem of the Faculty resides in the fact that two differing disciplinary careers are imparted in it, and the academic personnel is assigned to one career or the other, with some exceptions. However, as there is affinity between the disciplines, it is possible to propose joint projects that aid in the promotion of the Faculty as a whole.

On the other hand, as was mentioned earlier, the opposition of one of the professors, leader of one of the disciplines, to carry out the reflection and design exercise, was known beforehand. This opposition, however, gradually became diluted as it was observed that the personnel in general became associated to a concrete project, and that it advanced in the attainment of its goals.

Results of the RDC

To fulfill the objectives described in the five different stages of the work method, the participants were divided in three groups. At the end of each stage a plenary session was carried out where each group shared results achieved with the other groups.

In the last stage, in line with the methodology, new groups were organized around the courses of action that the participants considered priority. The final plenary session consisted in the presentation of the projects elaborated by the new groups.

In what follows, a synthesis of the projects formulated by the participants is presented, preceded by a shared vision of the desired future.

The desired future

It is in this stage where one of the most cherished results of the RDC is obtained. It is here where the attempt is made to plan a bold and ambitious future for the Faculty, free of restrictions. The most relevant points on the future of the Faculty were obtained, in which both students and professors made a commitment toward an improvement of the activities that are established within the Faculty. The vision of that shared future is the following:

> We are a Faculty leader in the formation of professionals in both disciplines, with a staff of professors immersed and committed in the process of teaching-learning and in the research and personal development that complements the formation of students with leadership and with a high demand in the labor market. Our students have an adequate formation, are motivated and have vocation in the careers that are imparted. They are students that are more

linked to society, have more real practice and there are lower indices of desertion and failure. They are of high academic level. The professors, on their part, encourage innovating projects that are actually projected into practice, where students and professors converge. They also have a high academic level, with adequate profiles, are integrated, committed, with capacity and vocation and apply innovating methods of teaching.

The design of the projects

In the following, the courses of action or projects designed by the new work teams aiming to approximate the collectively drawn desired future are shown:

Group 1. *To implement a program that stimulates, foments and regulates the work of the academic bodies (remedial courses, departmental exams).*

Group 2. *Establish a program to link the Faculty with productive sectors that allows the realization of professional practices, social and employment service (client and supplier registries, training of consultants).*

Group 3. *To develop a permanent labor, lecturing and disciplinary training program in compliance with the MEIF (Integral and Flexible Educational Model) and the new technologies.*

Group 4. *To implement a program that promotes, stimulates and regulates the work of academic bodies, disciplinary groups and existing lines of generation and application of knowledge.*

Group 5. *To elaborate a plan that tends to the needs of academic personnel..*

Group 6. *Creation of a program for the promotion of knowledge (identification and dissemination of current competences and interests).*

Group 7. *Establish an integral program for the improvement of infrastructure (Mixed Committee for Improvements).*

Group 8. *Establish graduate programs, Ms and PhDs, as well as technically-oriented Bachelor's, in accordance with the requirements of the labor market.*

Grupo 9. *Academically link Statistics with Informatics and with other Faculties.*

Grupo 10. *To develop a student's admissions program that is coherent with the MEIF and with the entrance profile of the Informatics and Statistics study programs.*

Grupo 11. *Development of a program for the (soft) incorporation of Statistics to the MEIF.*

Follow-up interventions

There were two follow-up meetings at 4 and 8 months since the RDC. The format that was followed in both consisted of allowing all of the groups to present their advances and provide comments concerning support or obstacles that they had encountered during the development of thier tasks, the changes that they had had to implement in their original goals, and in come cases, the need to rename their course of action in order to better express its nature.

Through this process, it was possible to enroll the participation of the totality of the attendants, who were able to clarify doubts concerning some points, but above all, it was possible to witness the will of all the groups to support each other, contributing with ideas and information to bring projects to good terms.

First follow-up meeting

After the presentations on advances, which took place in the morning, an intense feedback session followed in which many ideas and recommendations emerged. It was suggested that the projects should consider the role of Faculty and university authorities, which should go beyond the sole creation of the colleges, and verify that they conduct activities for which they were created, observing their normative and operational frameworks. The need to establish guidelines that guarantee congruence and convergence in the work of these collegiate bodies was

also recommended. The elaboration of a Teacher's Development Program that would explain the need for training based on the Faculty's Development Project was suggested to one group, and that it should be considered as a fundamental part of the change effort. It was also suggested that they incorporate all the training needs of the other projects, offer open courses with recovery fees, and the resources obtained be used to implement new courses.

Another group was asked to incorporate Statistics professors in the analysis. New staff implies new activities, evolution of the curricula, new projects, new profiles, etc. In addition, they were asked to elaborate the Staff Growth Program that explains the need to hire new personnel with a profile that is congruent with the educational model, related to the Faculty's development program. The work group on infrastructure was asked to define clearly an integral program for the improvement of the infrastructure that sees to academic needs. The group was also asked to elaborate an integral diagnostics of the library: technical services, collection, furniture, normative framework, security instruments, satisfaction levels of library users, etc. Finally, they were asked that policies on waste, acquisitions, substitutions, etc., be made public. In other words, they were asked to socialize the library project.

Of foremost importance, participants agreed:

- that all formal applications to the different university units should be conducted by the corresponding authority figure, and

- to present the projects to the university president, as part of a Faculty development strategy.

Second follow-up meeting

The same format was followed for this meeting, although the order of presentation was inverted with the aim providing a more adequate space to the academic which was being incorporated for the first time. This individual, which had exercised a certain pressure to nullify the RDC, intended now to collaborate with the rest of the group. In light of the results that had been achieved so far, he reverted on his decision to maintain himself away from the exercise and joined the rest of his colleagues.

The individual was included in group 11, which was the first to make its presentation, under the title *Development of a program for the (soft) incorporation of Statistics to the MEIF*, which is a government-mandated model with which all the career programs must comply. The reason he was invited to this Project is because the incorporation of Statistics to the MEIF was very delayed, partly because of this professor's opposition. Additionally, being a professor of Statistics and a leader of that group, it was very stimulating that he would now assume responsibility to advance the project.

The general recommendations that came out of this second meeting were:

- To strengthen the activity of the projects incorporating more students, either as an integral part of their course matter, through elaboration of theses or fulfillment of the social service requirement.

- To invite those professors which were not in any of the groups to participate in the projects.

- Identify meeting hours that are compatible with the majority. For example, early in the mornings before classes, or at break times ("active" lunch).

- The formal *Development Plan* is being implemented through the projects that are being conducted and begin to fructify. We believe that it is time to elaborate the document that formalizes the *PLADEA* (Development Plan) in accordance with the corresponding instructions.

Of these, the last is the most important: ***comply with the requirement to formulate the Institutional Development Plan without further delay.*** It was the appropriate time to formalize the existence of a development plan through its formulation, following the guidelines indicated by the university presidency, now that resistance to its materialization had been diminished. The Plan would be constituted by the projects in process, in addition to other elements that could be considered for inclusion.

Conclusions

This experience showed the capability of the Reflection and Design Conference to bring about a rapid convergence of points of view in face of a complex problem, like the one here presented. The difference in results obtained in an RDC with respect to those that could be obtained with different methods is notable. Normally in a traditional event, a series of papers are presented that are previously elaborated with no consensus behind them. In an RDC, the results are the product of the active participation of all attendants, which go through a gradual process of convergence and collective learning.

The RDC method is effective as a catalyzer of continual planning efforts. Subsequent actions, which are analyzed during the follow-up events, are irrefutable proof of results achieved in an intervention of this nature. Even though, as was expected, the Institutional Development Plan did not emerge during the exercise, the need for its existence and the will to give it a concrete form did. A good part of the Plan was in effect formulated during the RDC and its subsequent meetings.

With respect to the results achieved in the event, a clear vision of the important changes that the Faculty must face to improve the quality of its academic and administrative performance was reached, and with emphasis on the national demand for greater scientific and technological development. Above all, the need to implement such changes toward the inside of the institution were made evident, with the finality of preventing excisions or fractures that damage the capability of the Faculty to confront not only the challenge of academic excellence, but the challenge of survival in an environment that is extremely competitive and demanding such as the one that higher education presents in the country.

Even though the efficacy of the RDC to initiate processes of far-reaching change is recognized, it is necessary, and this does not always occur, to conduct a longitudinal follow-up of the implementation of the plans. This was done in the case that is being reported here and the results were very positive. Based on this experience, from this point on the RDC will be conducted only if the agreement with client organizations includes the follow-up of the process. That is, if it included several follow-up meetings, conducted in the course of at least one year.

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ROBUST FEATURE SELECTION AND CLASSIFICATION USING HEURISTIC ALGORITHMS BASED ON CORRELATION FEATURE GROUPS

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Abstract: The complexity of multidimensionality is one of the frequently encountered problems in the high-dimensional data space. The fact that multidimensionality in the data space increases and reaches great numbers brings about the problem that the number of non-informative ones among the features associated with the target class increases along with the data set complexity. The fact that all features included in the high-dimensional data space are not distinctive or do not contain critical information generally leads to difficulties at the learning stage. At this point, the importance of feature selection emerges. Feature selection is a problem of minimum subset selection from the original feature set for the best accuracy estimation. The neglected subject in the feature selection is ensuring that the inconsistency problem of the selected feature sets is brought to a solution. Studies carried out in recent years have focused on obtaining feature groups with which the group to which each feature belongs is associated with a class label rather than standard feature selection methods in which a single feature set is obtained. Within the scope of this study, each feature group obtained by group-based learning was presented as a solution candidate to heuristic methods. This paper proposes a novel feature selection method to Artificial Immune Recognition System (AIRS) variations in order to find robust gene sets from high dimensional microarray data. The unique feature of this feature selection method is that utilizes correlation based feature groups in order to increase the reliable classifying accuracy from optimal feature groups. We test the performance of the proposed local feature selection method for AIRS variations on high dimensional microarray data sets. We compare proposed LFSAIRS variations which are LFSAIRS1, LFSAIRS2, Parallel LFSAIRS1, and Parallel LFSAIRS2 with the Standard Genetic Algorithm (SGA), Sequential Forward Selection (SFS) and Sequential Backward Elimination (BES) approaches. Results of the robustness were evaluated by the Jaccard test and classification accuracy was evaluated using k-NN, SVM, Naïve Bayes and Random Forest classifiers. Results show that the proposed methods capable of finding robust gene subsets with high classification accuracy.
Keywords: Machine Learning, Local Feature Selection, Heuristic Approaches, Classification

Introduction

Gene expression microarray data sets due to the have characteristics such as high-dimensionality and small sample dimension their classification becomes hard. The fact that multidimensionality in the data space increases and reaches great numbers brings about the problem that the number of non-informative ones among the features associated with the target class increases along with the data set complexity. Many feature selection algorithms were developed for the purpose of reducing the dimensionality of this kind of data and improving the accuracy of classifiers. Feature selection is a problem of minimum subset selection from the original feature set for the best accuracy estimation.

Feature selection algorithms encountered inconsistency problem in many cases. One reason for the encountered inconsistency situation is the selection of the minimum feature set composed of features that give the best classifier accuracy, which is the classical purpose of feature selection algorithms. Furthermore, features having a high correlation with each other in the feature set defined by the feature selection algorithm can select different features in cases where the parameters of the feature selection algorithm are set differently. For the same feature selection algorithm, minor variations within the train data can also result in the selection of different feature subsets every time. Another reason for inconsistency encountered in feature selection algorithms is the small number of samples in the high-dimensional data space. The main observation here is that the groups formed by the associated features are generally present in high-dimensional data and these groups are resistant to the variations of training samples. Furthermore, sub-sampling of training data and the determination of stable feature

groups also make convergence possible to the structure of the original feature groups. Another observation is that each feature group is improved by being optimized with heuristic algorithms and learning is performed at the group level. Within the scope of this study, the feature groups formed by the correlation-based strategy within the feature selection framework were taken as a basis. An attempt to develop the correlation feature groups defined using high-dimensional data with the meta-dynamics of the local feature selection method to Artificial Immune Recognition System (AIRS) variations (LFSAIRS1, LFSAIRS2, Parallel LFSAIRS1, and Parallel LFSAIRS2) and the Standard Genetic Algorithms (SGA) was made. Then robust feature selection framework compared with Sequential forward selection and backward elimination methods.

Creating correlation based feature groups from high-dimensional data is mentioned in the second part of the paper, the methods used in the study are mentioned in the third part, the novel local feature selection method to Artificial Immune Recognition System (AIRS) is mentioned in the fourth part, the data set is mentioned in the fifth part, stability performance measurements is mentioned in the sixth part and the performance measurements of the optimal feature sub-groups obtained are mentioned in the seventh part.

Creating Correlation Based Feature Groups from High-Dimensional Data

Feature groups are an effective method to reduce the complexity of multidimensionality. At the same time, factors such as the use of feature groups in learning with high-dimensional data, reducing the complexity of the model, increasing the constancy of selected features, and the decrease of the variability of the estimator is also very effective. Studies carried out in recent years have focused on obtaining feature groups with which the group to which each feature belongs is associated with a class label rather than standard feature selection methods in which a single feature set is obtained. The fact that relational features have a very high correlation in high-dimensional data sets makes it possible to use feature groups by being taken as a basis. Thus, obtaining stable feature groups resistant to the sample number variation is ensured (Loscalzo et al., 2009). The fact that feature groups are obtained from data sets with characteristics such as small sample size and high dimensionality leads to obtaining unstable results or results that are not completely optimal. Therefore, the first step is to produce a set of feature groups by targeting the convergence to the original feature groups with the frames formed to obtain feature groups. The second step is to perform the feature selection process based on the set of feature groups produced. The idea of converging to original feature groups by creating a set of feature groups is based on the principles of group-based learning method.

In this study, relational feature groups were obtained by the CFG (Correlation Based Feature Group) algorithm. The CFG is a filter-based feature selection method that sorts the feature subset by the correlation-based intuitive function. The CFG algorithm examines the usefulness of subset of attributes based on a heuristic evaluation function. In choosing a correlation-based feature, each attribute is taken into account in the correlation between the attributes, as well as the predictive predicting of the class label. The value of the heuristic evaluation function used in the evaluation of the attributes is determined by equation 1. The intuitive usability of a subset of S attributes with k attributes is represented by $meritS$, the mean attribute-class correlation is presented by rcf for ($f \epsilon S$), and the correlation between the mean attributes is presented by rff parameters.

$$meritS = \frac{k*rcf}{\sqrt{k+(k-1)*rff}} \quad (1)$$

Each of the feature groups represents a solution candidate, and the presence of the related feature in a feature group was encoded with 1 while the absence of it was encoded with 0.

Methods

A. Artificial Immune Recognition Systems

Artificial Immune Recognition system is a novel immune inspired supervised learning algorithm and consist of biological immune systems metaphors. Artificial Immune Recognition Systems consist of the stages of initialization, memory cell recognition, resource competition and the selection of memory cells.
At the initialization stage, the data set is normalized to the range of [0,1]. After normalization, the affinity threshold is calculated by equation (2). At the next stage, antigens are presented to the storage pool with antigen training. At the memory cell recognition stage, a stimulation value is assigned to these cells by stimulating the recognition cells in the memory pool. Affinity is calculated by equation (3), the stimulation values are calculated by equation (4) and (5). The recognition cell with the highest stimulation value is calculated by equation (6) then M_{cmatch} cell is cloned and mutated. The number of clones is calculated by equation (7),

$$affinity\ \ threshold = \sum_{i=1}^{n} \sum_{j=j+1}^{n} \left(\frac{affinity(\text{agi,agj})}{n(n+1)/2} \right) \quad (2)$$

$$affinity(\text{agi, agj}) = 1 - \text{Euclidean distance}(\text{agi, agj}) \quad (3)$$

$$stimulation = 1 - \text{affinity} \quad (4)$$

$$stimulation(\text{mc, ag}) = \begin{cases} \text{affinity(mc, ag)} & \text{if mc. class} = \text{ag. class} \\ 1 - \text{affinity} & \text{otherwise} \end{cases} \quad (5)$$

$$\boldsymbol{Mcmatch} = \mathbf{argmax}(\mathbf{stimulation}(\mathbf{mc}, \mathbf{ag})) \quad (6)$$

$$\boldsymbol{numClones} = \mathbf{stimulation} * \mathbf{clonalRate} \quad (7)$$

At the resource competition stage, when mutated clones are added to the ARB (artificial recognition spheres, antibody) pool, competition begins for the time source. According to the stimulation value, limited resource assignment to the ARB pool is made according to the stimulation value. ARBs without enough resources are removed from the system. When the stop criterion is achieved, the process ends, and the ARB with the highest stimulation value is selected as the candidate memory cell. At the selection of memory cells stage dynamically and evolving developed Memory cell pool in the algorithm is used for the classification process.

The basic steps of the AIRS1 algorithm, the first version of artificial immune recognition systems, and the AIRS2 algorithm, the second version, are same. The main difference between them is that the ARB pool is used as a permanent resource in the AIRS1 algorithm, it is used as a temporary resource in the AIRS2 algorithm. In the case of being used as a permanent resource, ARBs remaining from previous steps cause the algorithm to spend more time by being involved in the competition for limited resources. Therefore, the complexity of the AIRS2 algorithm is less. While AIRS1 uses the mutation parameter that can be defined by the user, AIRS2 uses the concept of somatic hyper mutation where the mutation ratio of a clone is proportional to the affinity (Torres et al, 2016). While the classes of clones may change after the mutation process in the AIRS1 algorithm, classes are not allowed to change in the AIRS2 algorithm.

Parallel-AIRS1 and Parallel-AIRS2 versions demonstrate the distributed nature of the immune systems and their parallel processing qualities. At first, each part of the training data set is assigned to np number of processes. Thus, it is ensured that np number of the memory pool is created by running the AIRS algorithm on each process. As a result, the memory pools obtained are merged (Vijendra & Laxman , 2013).

In this study, the affinity threshold value, clonal ratio, mutation ratio, np, total source, stimulating value, hypermutation ratio, run number and iteration number parameters of the Artificial Immune Recognition Algorithms took the values of 0.1, 10, 0.15,2, 150, 0.9, 2.0, 30 and 50, respectively. The fitness function of each solution candidate was calculated according to accuracy of the KNN classifier.

B. Standard Genetic Algorithms

Standard Genetic Algorithms (SGAs) are adaptive heuristic search algorithms based on natural selection and evolutionary ideas. It is based on Darwin's principle of "survival of the fittest" and firstly proposed by John Holland, his colleagues and their students at the University of Michigan.

In genetic algorithm the initial population is generated first. Every individual in the population represents a solution candidate. Each representing a possible solution to a given problem. The evaluation of each candidate solution is performed according to the fitness function determined for the problem. Each individual goodness is represented by its fitness. Individuals in the population should be selected to form a new population. Individuals in a population compete for resources and mates. To ensure the formation of a new generation following the crossover and mutation operators of the two selected individuals. Genes from "survival" individuals propagate throughout the population.

In this study, the regular crossing of the crossing methods and tournament selection of the selection methods were used. While the population size of the genetic algorithm parameter takes the value of 100, chromosome length varies according to the dynamic size of the feature group. The mutation ratio, number of tournaments, number of runs and number of iterations of the algorithm took the values of 0.8, 2, 30 and 50, respectively. The fitness function of each solution candidate was calculated according to accuracy of the KNN classifier.

C. Sequential Forward Selection and Backward Elimination

Sequential forward and backward selection techniques are simple and effective methods for selecting an attribute. While these methods create a set of attributes, they perform an extraction or addition of an attribute from the attribute subset according to the method selected at each step. The selection criterion here is the performance ratio of the classifier algorithm. According to the performance status of the specified classifier algorithm, the discriminative attributes are determined at each step. For both approaches, KNN classifier was used. In this study, run number and iteration number parameters of the Sequential forward and backward selection techniques took the values of 30 and 50, respectively.

Local Feature Selection Method to Artificial Immune Recognition System

A. LFSAIRS steps:

1. The initial set of feature group sets are created based on CFG algorithm.
2. Do for each Antigen (Ag) until training process is completed:
    - 2.1. Calculating fitness value of the each feature set is calculated by taking into account only best matching cell
    - 2.2. Until termination do :
    - 2.3. The highest fitness value of the feature set is selected as a best feature set
    - 2.4. Generation of l clones of the best feature set
    - 2.5. Mutation of the each clone
    - 2.6. Calculating fitness of the each clone by taking into account only best candidate cell
    - 2.7. Set the highest fitness value of the feature set as a candidate optimum feature subset
    - 2.8. If best candidate cell is sufficient calculate the optimum subset then go step 3. else go 2.3
3. After memory cell replacement stage, set the optimum subset of attributes as the subset of the new attribute. If training process is completed go to Step 4, else go to step 2.
4. Selection of the best optimized feature set
5. Classification of the best optimized feature sets based on test set

B. LFSAIRS Flowchart:

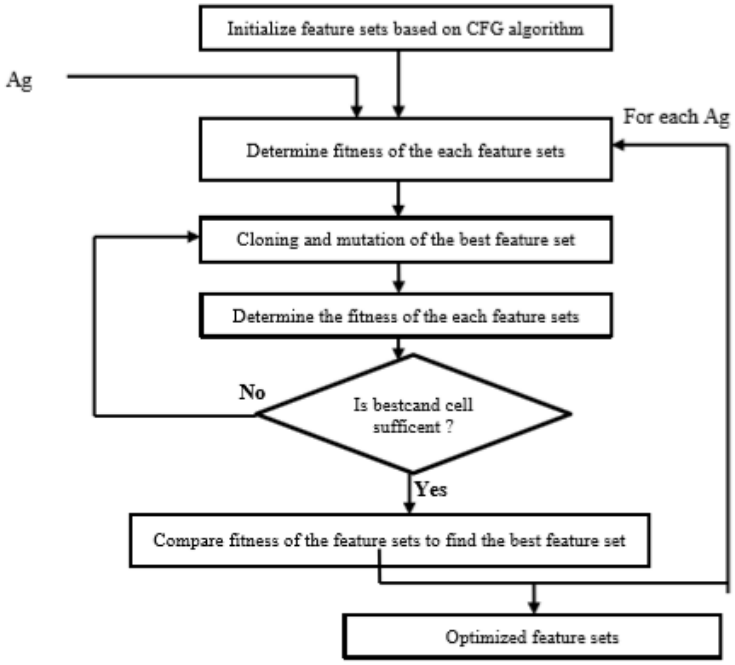

Figure 1. LFSAIRS local feature selection

Data Sets

The most common six microarray data sets were used in this study. Table 1 includes information on the genes, samples and class numbers contained in the data sets used in this study (Loscalzo et al, 2008).

Table 1: Microarray Data set

Dataset	Gene	Sample	Class
Colon	2000	62	2
Lungstd	5000	181	2
Prostate	6034	102	2
SRBCT	2308	63	4
Lymphoma	4026	62	3
Leukemia	7129	72	2

Experimentally obtained performance values were obtained by dividing the data sets as 70% training and 30% test set. A number of bootstrap data sets were obtained from the training data set in order to ensure the resistance of training samples against variations. Then, *n* number of feature groups was selected by separately running the CFG algorithm on *t* number of bootstrap data sets. We set the *t* and *n* parameters respectively to 10 and 10 for all algorithms within the scope of this paper. The number of features contained in the feature groups obtained as a result of the CFG algorithm varies dynamically specific to each data set. Learning was performed at the group level by improving the feature groups presented to the LFSAIRS1, LFSAIRS2, Parallel-LFSAIRS1, Parallel-LFSAIRS2 and Standard Genetic Algorithm like a single cell. While stability results were evaluated by the Jaccard test, their classifying accuracy was evaluated using k-NN, SVM, Naïve Bayes and Random Forest classifiers. WEKA was used to obtain classifying accuracies. For all algorithms the classifying accuracy of the most optimal solution candidate obtained at the end of each run was obtained using the test data set with 10 cross validations. The performance values added to the results were calculated by taking the average of the number of runs.

Stability Performance Measurements

The stability of feature selection approaches is obtained by measuring the similarity between feature sets. In this study, the Jaccard index was calculated using the formula given in equation (8). Parameter *m* was used to specify the number of feature sets while expressing two feature sets used for *Si* and *Sj* similarity measurement.

$$Jaccard_{Index}=IJ(Si,Sj)=| Si \cap Sj | / | Si \cup Sj | \quad (8)$$

The stability estimation was calculated using the Jaccard test formula specified in equation (9). The fact that the obtained result was high means that the stability of the relevant feature set was also high.

$$\sum(S)= \frac{2}{m(m-1)} \sum_{i=1}^{m-1} \sum_{j=i+1}^{m} IJ(Si,Sj) \quad (9)$$

Performance Results and Discussion

Within the scope of this study, it was focused on the problem of stability encountered in feature selection algorithms. As a solution to this problem, stable feature groups were obtained by combining group-level learning with the meta-dynamics of heuristic approaches.

Table 2: Average Classification accuracy of Algorithms with CFG based on k-NN and SVM

	k-NN					*SVM*				
Data set	***LFSAIRS2 %***	***LFSPAIRS2 %***	***LFSAIRS1 %***	***LFSPAIRS1 %***	***SGA %***	***LFSAIRS2 %***	***LFSPAIRS2 %***	***LFSAIRS1 %***	***LFSPAIRS1 %***	***SGA %***
Colon	80	81.1	75.8	78.8	80	82.1	85.6	83.7	83.4	81.4
Lungstd	**91.6**	**86.8**	**87.2**	**86.9**	**89.1**	**91.6**	**93**	**94.1**	**92.3**	**93.3**
Prostate	53	58.5	59	59.7	54.2	48.2	45.4	48	47.8	50
SRBCT	**86.5**	**85.3**	**86.1**	**83**	**84**	**88.4**	**89.7**	**87.6**	**87.7**	**88.1**
Lymphoma	76.9	76.5	76.1	77.6	73	88.4	86	83.4	82.8	80
Leukemia	**84.6**	**84.6**	**82.2**	**83**	**82**	**83.3**	**86.1**	**85.3**	**86**	**82.6**

Table 3: Average Classification accuracy of Algorithms with CFG based on NB and RF

	Naïve Bayes					*Random Forest*				
Data set	***LFSAIRS2 %***	***LFSPAIRS2 %***	***LFSAIRS1%***	***LFSPAIRS1 %***	***SGA %***	***LFSAIRS2 %***	***LFSPAIRS2 %***	***LFSAIRS1%***	***LFSPAIRS1 %***	***SGA %***
Colon	74.6	75	74.7	70.3	70.7	69.2	71.1	72	68.4	68.4
Lungstd	**97.2**	**95.9**	**95.8**	**95.8**	**95**	**88.8**	**89.7**	**90.2**	**89.4**	**90**
Prostate	52.3	51.1	51.4	54.7	55.2	65.3	65	63.3	62.8	61.9
SRBCT	37.6	36.1	38.4	38.8	36.1	38.4	41.9	41.5	42.3	38.4
Lymphoma	**76.9**	**76.9**	**76.9**	**78**	**76.9**	**78.4**	**77.6**	**78.4**	**78**	**76.1**
Leukemia	**86.6**	**86.6**	**86.6**	**86.6**	**86.6**	**84.6**	**86**	**84**	**84.6**	**84.6**

Table 4: Average Classification accuracy of Sequential Forward Feature Selection (SFS), Backward Elimination Feature Selection (BES) based on SVM, NB, RF and k-NN

	SFS				*BES*			
Dataset	***k-NN***	***SVM***	***NB***	***RF***	***k-NN***	***SVM***	***NB***	***RF***
Colon	71.5	70.7	59.2	76.9	76.9	78.8	76.9	71.1
Lungstd	98	93.3	95.8	95	**98.1**	94	94.5	95
Prostate	72.3	75.2	75.7	64.7	74.5	78.2	76.1	74.5
SRBCT	86.9	60	61.5	57.6	84.6	82	**41**	46.1
Lymphoma	92.3	76.9	76.9	81.5	84.6	80.7	76.9	76.9
Leukemia	86.6	86.6	80.6	80.6	83.7	82.8	80.6	83.1

Table 5: Stability Results of Algorithms Based CFG and SFS, BES

Dataset	*LFSAIRS2*	*LFSPAIRS2*	*LFSAIRS1*	*LFSPAIRS1*	*SGA*	*SFS*	*BES*
Colon	0.8	**0.9**	0.85	**0.9**	0.8	0.51	0.5
Lungstd	0.8	**0.9**	0.81	**0.9**	0.8	0.54	0.55
Prostate	0.71	**0.9**	0.83	**0.92**	0.8	0.6	0.51
SRBCT	0.8	**0.9**	0.8	**0.9**	0.8	0.67	0.63
Lymphoma	0.89	**0.9**	0.8	**0.91**	0.83	**0.72**	0.69
Leukemia	0.81	0.89	0.79	**0.9**	0.85	0.71	**0.7**

Table 6: Average Selected Feature size Results of Algorithms Based CFG and SFS, BES

Dataset	*μ LFSAIRS2*	*μLFSPAIRS2*	*μ LFSAIRS1*	*μ LFSPAIRS1*	*μ SGA*	*μ SFS*	*μ BES*
Colon	48.5	49.9	47.4	48.9	40.4	4.8	43.75
Lungstd	54.7	61.8	57.5	60	45	6.0	48
Prostate	52	62	62.3	61.1	41.8	8.4	44.2
SRBCT	69.3	68	68.6	66.7	44.9	9.2	47
Lymphoma	99.6	99.1	95.9	95.3	62	4.4	63
Leukemia	123.6	124.8	123.1	**125.1**	61.6	**4.0**	64.1

According to the average classification accuracy results shown in Table 2 and Table 3, it was observed that the algorithms achieved highest classifying accuracy result respectively in the Lungstd, SRBCT and Leukemia data sets for KNN and SVM classifiers and It was observed that the algorithms achieved highest classifying accuracy result respectively in the Lungstd, Leukemia, Lymphoma data sets for Naïve Bayes and Random Forest classifiers. It was observed that the highest classifier performance achieved by the LFSAIRS2 algorithm on Lungstd data set by 97.2% based on Naïve Bayes classifier and the lowest classifier performance showed by LFSPAIRS2 and SGA algorithms on SRBCT data set by 36.1 % based on Naïve Bayes classifier.
In Table 4 including the average classification accuracy results of Sequential Forward Selection and Sequential Backward Elimination approaches applied on six microarray data sets. It was observed that the algorithms achieved highest classifier performance by the Sequential Backward Elimination approach on Lungstd data set by 98.1% based on K-NN classifier and the lowest classifier performance showed by the Sequential Backward Elimination approach on SRBCT data set by 41 % based on Naïve Bayes classifier.
Table 5 shows the stability results of the algorithms. The results showed respectively LFSPAIRS1 and LFSPAIRS2 algorithms gave the highest stability results and BES and SFS algorithms gave the lowest stability results. While it was observed that the LFSPAIRS2 algorithm generally gave close results by 90% stability on data sets except Leukemia. LFSPAIRS1 algorithm generally gave close stability results by 90% on data sets. LFSPAIRS1 algorithm respectively gave highest stability results on Prostate and Lymphoma. It was observed that the SFS algorithm achieved the highest stability performance by 0.72 on Lymphoma data set and the lowest stability performance by 0.51 on Colon data set. It was observed that the BES algorithm achieved the highest stability performance by 0.7 on Leukemia data set and the lowest stability performance by 0.5 on Colon data set.
In Table 6, we present the average selected of feature size of the algorithms. The comparison results showed that the feature reduction capacity of the SFS algorithm was better compared to the other algorithms. It was observed that the feature reduction capacity of the SGA algorithm was better compared to the artificial immune recognition algorithm versions and BES approach. It was observed that the highest average feature size showed by the LFSPAIRS1 algorithm on Leukemia by 125.1 and the lowest average feature size achieved by the SFS algorithm on Leukemia by 4.0.

Conclusion

In high-dimensional data space, the feature subsets obtained by the feature selection algorithms cannot be stable despite having good classifier performances. The lack of stability means that the feature subsets that field experts will use in their studies will decrease the reliability of the experiment. In this study we proposed a robust feature selection framework with a novel local feature selection technique. Within the scope of this study, each feature group obtained by group-based learning was presented as a solution candidate to heuristic methods except sequential forward selection and backward elimination algorithms. When the performance results obtained were examined, it was concluded that feature groups obtained at the correlation base increased their robustness by being improved with the meta-dynamics of heuristic approaches like a single cell. The classifier and stability results obtained were compared with six commonly used microarray data sets.

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TEACHING ENGLISH FOR CHEMISTRY AT A JAPANESE UNIVERSITY

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Abstract: Although studying English presents considerable difficulties for Japanese university students, in this time of globalism, our students are expected to read and write academic articles in English. To address this problem, we chose a basic word list of 2188 words, and compiled an academic word list of 776 words for a sub-discipline of organic chemistry using a "tailored" corpus. The two lists combined cover 85.72% of words in 100 papers from an academic journal, which would facilitate students' access to the sub-discipline in English.

Keywords: ESAP, academic word lists, tailored corpora

Introduction

Reading and writing academic papers in English presents considerable difficulties for Japanese university students. One important contributing factor to this difficulty is the students' lack of appropriate vocabulary needed to consume and produce academic papers in English. In a Japanese context, these lexical gaps can be attributed, in part, to the absence of informed and carefully created word lists based on students' needs. In order to begin approaching the word coverage necessary to read academic articles in English, not only do learners need to know high frequency words from a basic word list, but also a sufficient number of academic words connected to their specific sub-discipline. Thus, one means of alleviating this difficulty that Japanese students face is by employing corpora in the selection and compilation of basic and academic word lists.

As for a basic word list, although the Japanese Ministry of Education and Science states that a student should learn 3,000 English words at junior and senior high school, it does not specify exactly which words to learn. Thus, an English instructor at a Japanese university needs to select which basic word list to provide students with prior to teaching academic words. However, there are some reasons why basic word lists compiled in English-speaking countries such as *GSL*, *NGSL*, *the BNC/COCOA lists* are not appropriate as the basic word lists in Japan. Another issue is an academic word list: we need a concise and precise word list for our students to learn efficiently over a short period of time. To solve this problem, Coxhead (2000a, b) proposed The Academic Word List, hereafter AWL for short. She claimed, together with a basic word list of 2,000 words, her AWL covers 95% of any kind of academic writing. Since then, a number of English for General Academic

Purposes (hereafter EGAP) academic word lists have been compiled. Hyland & Tse (2008), however, who contend that it is impossible to compile a list for academic English in general. Instead, they posit that all we can do is compile academic word lists for each individual discipline, namely, English for Specific Academic Purposes (hereafter ESAP) academic word lists. Since then, several ESAP academic word lists have been compiled. In this research, we discuss issues concerning a basic word list, an academic word list for Chemistry, and how to compile an academic word list for Chemistry using a "tailored" corpus.

Materials and Methods

We chose JACET2188 as the basic word list for two reasons: 1) the list is based on English teaching textbooks published by major Japanese textbook companies and 2) the list is oriented towards academic writings, which differentiates itself from lists complied in English-speaking countries (e.g. GSL, NGSL, BNC, COCA, Oxford2000/3000), which are oriented towards conversation. We designed our academic word list to be ESAP for chemistry majors. Moreover, we decided it should not be chemistry in general but a sub-discipline of chemistry, namely, organic chemistry. This would allow for us to develop more fine-tuned word lists for those learners involved in this sub-discipline of chemistry. Furthermore, we selected one academic journal of organic chemistry rather than several academic journals of organic chemistry. It is crucial that the list is entirely made for the journal. This reason is that a highly customized list for a specific journal would allow for learners to engage in the narrow reading of highly similar articles. As learners begin to learn words from the word lists, not only will their word coverage increase for the journal's articles, but they will also be able to deepen their lexical knowledge through seeing the same words many times and in varied contexts. By developing a list in such a way, we "tailor" it to suit the specific needs of a learner population, which in this case are Japanese chemistry students who engage in the narrow reading of organic chemistry in a targeted journal. That is why we call the list "tailored". Just like tailors pick up a fabric, we picked up one particular academic journal. To the best of our knowledge, this is the first academic word list targeted for a single academic journal. 100 papers from an online journal, *Journal of American Chemical Society* (hereafter JACS for short) were chosen, around 0.6 million in total. We turned the 100 papers into an online corpus database, which allowed us to retrieve words automatically. Out of the corpus, we retrieved words automatically. See Shimizu & Murata (2010, 2012, 2013, & 2015) for how to compile a corpus and retrieve words. After compiling the corpus, we parsed the texts, tagged and stemmed words, extracted all words according to occurrences, and obtained nouns, verbs, adjectives, adverbs, and others. Following this, we selected frequent words, which we defined as those words occurring over 50 times for nouns, verbs, and adverbs, and over 100 times for adjectives and others. Next, we deleted words listed in New JACET2188 from the academic word list unless they were: 1) listed with different parts of speech or, 2) technical terms. The final stage was also key to this research because frequency searches alone cannot account for the full range of what makes a word useful. Thus, we asked chemistry experts for their opinions on English for the journal, and deleted and added words accordingly.

Results and Discussion

As a result, an academic word list of 598 nouns, 134 verbs, 38 adjectives, 4 adverbs, 4 others, and 787 words in total, were obtained.

First, we will turn our attention to the nouns. The top 10 most frequent nouns are *Figure* (1064 times), *datum* (742), *protein* (722), *molecule* (495), *complex* (459), *substrate* (480), *pH* (438), *NMR* (426), *spectra* (425), and *mechanism* (419). We might regard a few words such as *Figure*, *datum* and *mechanism* as EGAP. Observe *Figure* is spelt with the capital *F* here because the word is used as *in Figure 3.2*. EGAP words, however, consists of just 14.16% of all nouns in the list. The majority of nouns are ESAP words such as *protein, molecule, complex, substrate, pH, NMR,* and *spectra*. Note the word *complex* here is not an adjective but a noun, "a type of compound."

The top 10 most frequent verbs are *observe* (595), *support* (519), *determine* (425), *contain* (419), *bind* (415), *suggest* (405), *form* (378), *obtain* (377), *provide* (364), and *indicate* (335). The majority of the top 10 most frequent verbs are EGAP words such as *observe, support, suggest, obtain, provide, indicate, determine* and *contain*. However, we also have ESAP words such as *bind* and *form*. When we consider the whole verbs, we recognise that EGAP words are only 28.57 % of all verbs of the list.

EGAP words such as *experimental (480), binding (362), molecular (346), structural (298), catalytic (269), solvent (251), significant (223), consistent (211), available (205), radical (179)* are the top 10 most frequent adjectives. However, we also have ESAP words such as *binding, molecular, catalytic,* and *solvent.* EGAP words consist of 37.57% of adjectives in the list. The top 10 most frequent adverbs, *respectively* (199), *previously* (164), *significantly* (131), *approximately* (100), *relatively* (97), *typically* (67), *furthermore* (67), *readily* (64), *experimentally* (64), *negatively* (61) are all EGAP words, but we also have ESAP words. EGAP words consist of 28.57% of adverbs in the list. Others, mainly prepositions and conjunctions, *due to* (101), *such as* (86), *whereas* (84), and *as well as* (54), are all EGAP words.

Let us now discuss whether the academic word list should be EGAP or ESAP. According to Paquot (2010), her Academic Keyword List (henceforth AKL), an EGAP academic word list consisting of 354 nouns, 233 verbs, 180 adjectives, 87 adverbs, and 75 others, covers 95% of any academic writing, including academic journal articles, textbooks, PhD dissertations, MA theses, and lab reports. We compared AKL with The JACS academic word list. It turned out that only 18.29% of all words are common. The nouns common to AKL and The JACS academic word list, for instance, are *Figure, datum,* and *mechanism,* which are general, but occur frequently in the academic journal.

In contrast, nouns occurring only in the JACS academic word list are specific to Chemistry. Note that the word *complex*, for example, is not an adjective meaning "difficult to understand" but a noun meaning "a kind of compound". We took chemistry experts' advice and deleted quite a few words such as *sugar* and *H*, which they considered too basic. There was another set of words we deleted after following their advice such as *alamethicin*, *bicelles*, and *dysfanction*, which were too technical. We also added words which chemistry professors recommended. In other words, their opinion aided in fine-tuning the list for maximum utility.

We now turn to nouns occurring only in AKL, namely, *ability*, *action*, *advice*, *adult*, *age*, and so on. We see that they are not relevant to Chemistry. We could safely claim that an EGAP list might not be very efficient.

We checked the coverage of New JACET2188 and the JACS academic word list. We discovered that the coverage of the former is 70%. Incidentally, the coverage of General Service List is 63%, which suggests that the JACET list is a more suitable basic list for students. The coverage of the JACS academic word list is 15.72%. The total coverage is 85.72%, and we would like to state that it is satisfactory for a start.

Conclusion

To conclude, we claim that a basic word list and an ESAP academic word list can provide an efficient platform for English for Chemistry majors reading academic papers in English. We would like to improve the coverage of 85.72% to 90% in the near future, and 95% ultimately, so that English learners can reach the threshold necessary for reading seamlessly without the need to consult a dictionary.

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USE OF INFORMATION TECHNOLOGIES IN APPLICATION SPHERE

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Abstract: When conducting their business, companies increasingly apply the use of information technologies, which are to facilitate the work of employees at all positions. This study deals with their use in quality management system, where it is important to apply the most advanced forms of management and use every opportunity to improve the quality in general. On a sample of three large companies in South Bohemia region (the Czech Republic), we aim to discover the current state of using information technologies in the application sphere. Two research assumptions were established and the purpose will attempt to confirm / to refuse them through two research approaches: interviews with managers of all 3 observed companies and a subsequently compiled questionnaire distributed to the total of 130 employees of the companies. The assumptions were as follows: 1) To achieve the required quality, companies must use information technologies; 2) Information technologies are used in companies with quality management system, regardless of their business. The results of research, concerning the quality and information technologies, confirmed a particular connection between the use of information technologies and the resulting quality.

Keywords: Information Technologies, Private sector, E-learning

Introduction

When conducting their business, companies increasingly apply the use of information technologies, which are to facilitate the work of employees at all positions. This study deals with their use in quality management system, where it is important to apply the most advanced forms of management and use every opportunity to improve the quality of supply (cp. Kožíšek & Stieberová, 2010; Janeček, 2001; Veber 2006; Nenadál, 2001). Eriksson (2016) reminds that large companies are ahead of small and medium enterprises in the race for quality progress. In general, it means that in comparison of public with private companies, private ones do better, and the practice of process management seems to be easier for private firms (Eriksson, 2016). Quality management may be a source of competitive advantage (Elshaer & Augustyn, 2016).

Information technologies are means and procedures, devices as well as systems that help one to work with information more efficiently. In order to perform the aforementioned functions, information technologies consist of computer sets and other elements. Therefore, the basic building block is hardware in the form of computer sets, printers, fax machines, telephones, etc. Other elements include software equipment, i.e. basic (operating systems, office applications, programming languages, etc.), application (programs for production control, trade control ...) as well as technology (e-mail, word processor, etc.) or communication networks, workstations, robotics and smart chips (Vymětal et al., 2006). According to Tvrdíková (2000), based on the levels of management, information systems are classified into transactional systems, information management systems, decision support systems and senior management support systems.

In their operations, many companies frequently use separate information systems (e.g. one for production management and the others for logistics, distribution, asset management, sales, billing, accounting, human resources, etc.) instead of one that is integrated (Odbor statistik rozvoje společnosti, 2011, 22). Integrated information system provides a comprehensive view and delivers a complete information package for professional positions in the given company (Zounek, 2009; Rábová 2008; Truneček et al., 1997).

Research goals

On a sample of three large companies in South Bohemia region (the Czech Republic), the authors aim to discover the current state of using information technologies in the application sphere.

Two research assumptions were established and the purpose will reside in an attempt to confirm / to refute them through two research approaches: interviews with managers of all 3 observed companies and a subsequently compiled questionnaire distributed to the total of 130 employees of the companies. The assumptions are as follows:

1. To achieve the required quality, companies must use information technologies.
2. Information technologies are used in companies with quality management system, regardless of their business.

Methodological Approach

On approaching the companies, it was necessary to select those having available quality management, and to create a questionnaire based on interviews with managers of the companies. The included questions mainly concerned the companies themselves, their attitude to quality and information technologies, and how these two elements are used by management of the companies to make their operations more effective.

When creating the questionnaire, the biggest effort was put in the answers' informative value, while maintaining a certain clarity for an average respondent without detailed knowledge of management terms. The data analysis objective was to evaluate the possibilities of use and the amount of benefits (or failures) of information technologies in quality management system in the South Bohemian companies. Therefore, it was essential to approach companies with quality management systems and to select those fulfilling the requirements of the ISO 9001 certification. Since the selections included companies with quality management systems that may be applied virtually to any area (field), the companies each have different core businesses.

Research sample

Company 1: The manufacturing enterprise in the field of telecommunication, founded in 1991 as a company dealing with automation and measuring technologies in various fields as industry, food business, energetic and health. The main interests of the company today are telecommunications services together with the construction of telecommunication systems, solar systems and software equipment. This company interest comprises also sort of e-commerce. Despite its focus, the company poses no integrated information system but several information systems are used for various activities such as warehousing or accounting. Despite the lack of integrated information system, the company deals with using electronic invoicing to make it easier for the accounting department (the need to improve quality by reducing error rates). This is also confirmed by the obtained quality certificate in that field.

Company 2: The franchisee company operating in the field of services. It entered the Czech market in 1998. The main subjects of business are providing services in the field of vehicle rental and operational leasing. This company uses an integrated information system for the purpose of effective company managing. The security of this system is ensured not only by using the strong passwords, but also by electronic signatures. An intranet is also very important part of the company's information technologies. The intranet is used for communication with employees and for controlling them. This company strategy comprises a complex e-commerce business. They offer for long years full services via Internet (booking and payment). Regarding quality, the company received quality awards for best services, best customer services etc.

Company 3: In the rail transport engaged company that focuses on a wide range of shipments. The company offers a specialized solution systems for almost every kind of goods, but they are specialized in transportation of solid fuels and construction materials. Liquid goods can be transported in tanks. Moreover they are able to transport also military consignments or engineering raw materials and machines. The company uses an integrated information system and an intranet. The Internet is restricted for some employees. It was also found that the company is seeking for obtain quality certificates and they also tries to implement new systems for improving their business.

The research data, which allow us confirm or avoid the determined research assumptions, represents the answers of 133 employees of the companies described above. Of these, 55% were male (73 respondents) and 45% female (60 respondents). The age of the respondents represent 14 persons under 25 years of age, 49 respondents are aged 26-35 years, the same number of persons (also 49 respondents) are aged between 36-45 years, 16 persons in the 46-55 age group and 5 respondents are aged over 55 years.

Results and Discussion

The three observed companies, albeit in different sectors (telecommunications, logistics), must use information technologies for their operations. The assumption – that companies working with quality management system maximize the use of computers and technologies in all workplaces – was confirmed, with the use of computer networks, namely Internet and Intranet, being at a very high level as well. However, it was surprising to determine the absence of Intranet in company 1. Likewise, this company lacks any integrated information system, as opposed to companies 2 and 3. These findings were all the more surprising, since company 1 has newer and hence more modern information technologies than the other observed companies. In comparison with them, this company (1) also differs in other aspects, such as not using any e-learning. According to the answers of the company 1 management, this is due to the fact that the company is completely housed in one building and thus there is no need to use this method of training or any further qualification expansions. From their perspective, centralization is the reason for the Intranet absence as well.

As the survey results show, 95% of respondents agree with the claim that the company they work for seeks for quality improvement by using, in particular, information technology. Only 5% of respondents (representing only 7 people), don't agree to this claim. Especially, in the company 2, 100% of respondents agree with the idea of improving quality with help of using of information technologies. It is quite understandable, considering the type of business and the age structure of employees, which are very young and thus closer to modern trends in the field of information technologies.

The extent of the IT using in work

The respondents used a scale from 1 to 5. Most respondents (66) chose highest value 5. The second largest number of respondents (61) chose value 4, which represents also a high rate of utilization. The remaining 6 respondents indicated the middle value 3.

Table 1: The extent of the IT using in work (comparison of Internet and Intranet using)

	Using of Internet for work		Using of Intranet for work	
	Yes	No	Yes	No
Company 1	47	0	0	47
Company 2	15	23	38	0
Company 3	15	33	48	0
Total	77	56	86	47

Documentation system used at the workplace

The combination of electronic and paper documentation form is the most used system in all three companies (78%). It is positively surprising that only paper form of documentation we can't find in any company. Companies are aware of the information technologies benefits in the sense of speed and economy as opposed to slow and non-ecological paper form of documentation.

Table 2: The form of documentation system at the workplace

	Electronic database	Paper form only	Combination of both
Company 1	20	0	27
Company 2	4	0	34
Company 3	5	0	43
Total	29	0	104

Using of e-learning at the workplace

The results we get are very specifically balanced. It's influenced by the fact e-learning is completely missing in the company 1. On the contrary, situations in the companies 2 and 3 are very diverse. The difference is probably caused by different positions of respondents. Few of them hardly know what's the word e-learning about, others use it very often. Nevertheless, the results illustrate the companies' effort for an effectiveness in the cost reduction

when we talk about the staff training and learning. The differences are also result of diversity in companies' sizes. Company 1 where isn't e-learning used in any form is quite small company and all employees work in one building.

Table 3: The purpose of using e-learning at the workplace

	Obligatory training according legislation	Vocational training	Qualification expansion	Other
Company 1	0	0	0	0
Company 2	27	7	0	0
Company 3	40	12	10	0
Total	67	19	10	0

Using of specialized programs for work

According to respondents' answers, companies use the mostly from 1 to 2 specialized programs This percentage represents 69 respondents. (52%). The need for 3-4 specialized programs for work has been expressed in answers of 52 respondents (39%). Multiple programs for work, i.e. 5-6 used by only 10 respondents.

The importance of information technologies from the employees' point of view

The respondents answered the question "How much would change the impossibility to use information technologies the quality of your work" and they used a scale from 1 to 5. The majority of the 70 respondents (representing 53% of respondents) thinks that the quality of their work would definitely suffer (answer "5" on scale) in the case if they could not use the information technology. The second largest part of respondents chose the answer "4". The result of these The answer to the question is the determination of respondents' dependence on information technologies, for quality job performance. The average response rate respondent is very high, namely 4,51. Respondents therefore believe that their work is greatly influenced by information technology. The average answer of company 1 respondents is 4,51, higher average was reported by company 2 with a value of 4,71 and company 3 has the lowest average of 4,25.

The results show that the use of information technologies in companies, pursuing a comprehensive improvement and quality control, is necessary as well as it is very effective. Each of the observed companies uses quality management system, and both the equipment and the use of information technologies are at a very high level.

Conclusion

The study aimed to find out the possibilities of using information technologies in companies that have available quality management system (see Nanda, 2005). It was also necessary to determine whether these technologies provide the desired effect. The objective was met as it turns out that the possibilities of using information technologies are virtually limitless and very effective, and the above information technologies are used by companies from all sectors for a great variety of activities.

Despite all three companies use the information technologies, their application remains in some aspects individual. Some companies can obtain bigger and some only minor benefits. However, the basic purpose in saving the budget and improving the quality in general benefit for all of them. As confirmed in the research, these information technologies save the time of the staff. Thanks to this savings, the companies are able to save also in reducing the number of full-time job positions that would have to be created without the use of information technology. More efficiency can be seen in communications, where new technologies have enormous benefits (cp. Rábová 2008; Truneček et al., 1997). For larger companies it's easier to communicate through corporate networks or Intranets among single departments, as well as sharing data. Of course, communication does not only concern the internal business. Internet is unnecessary form of communication with the world outside of company.

It is clear from the obtained data that the information technologies are used by companies, regardless of their business focus. This confirmed the first established assumption: Information technologies are used in companies with quality management system, regardless of their business. At the same time, the questionnaire survey results and interviews with the managers also confirm the other research assumption: to achieve the required quality, companies must use information technologies. The results of research, concerning the quality assurance and information technologies, confirmed a particular connection between the use of information technologies and the resulting quality. Nevertheless, how suggests research findings of Ahmad & Schroeder (2002), managers should not limit their attention to potential employees' technical skills.

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