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EDITOR SPEECH

International Conference on Business, technology and Innovation is the 5th international interdisciplinary peer reviewed conference which publishes works of the scientists as well as practitioners in the area where UBT is active in Education, Research and Development.

The UBT aims to implement an integrated strategy to establish itself as an internationally competitive, research-intensive university, committed to the transfer of knowledge and the provision of a world-class education to the most talented students from all backgrounds. It is delivering different courses in science, management and technology.

This year we celebrate the 15th Years Anniversary.

The main perspective of the conference is to connect the scientists and practitioners from different disciplines in the same place and make them be aware of the recent advancements in different research fields, and provide them with a unique forum to share their experiences.

It is also the place to support the new academic staff for doing research and publish their work in international standard level.

This conference consists of sub conferences in different fields:

- Management, Business and Economics
- Humanities and Social Sciences (Law, Political Sciences, Media and Communications)
- Computer Science and Information Systems
- Mechatronics, Robotics, Energy and Systems Engineering
- Architecture, Integrated Design, Spatial Planning, Civil Engineering and Infrastructure
- Life Sciences and Technologies (Health and Food)

This conference is the major scientific event of the University for Business and Technology. It is organizing annually and always in cooperation with the partner universities from the region and Europe.

In this case as partner universities are: University of Vlora, University of Tirana – Faculty of Economics and University of Durres.

As professional partners in this conference are: Kosova Association for Control, Automation and Systems Engineering (KA – CASE), Kosova Association forModeling and Simulation (KA – SIM), Quality Kosova, Kosova Association for Management. This conference is sponsored by EUROSIM - The European Association of Simulation.

We have to thank all Authors, partners, sponsors and also the conference organizing team making this event a real international scientific event.

This year we have more application and publication than last year. Congratulation!
Edmond Hajrizi, Chair

University for Business and Technology

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Green Energy or Nuclear Power Plants

Besnik Skenderi, Diamanta Skenderi

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Abstract World seems to go green regarding the energy, however the cost of green energy is high and as a result of security issues nuclear energy seems to be avoided, while introducing business and outsourcing concepts nuclear energy seems to be solution.

Keywords: Energy, Environment, Shareholders, Outsourcing

1. Introduction

Since introduction of vapor machines, need for energy is permanent and this need is increasing every day. Despite the fact that technology is changing and new innovation had taken place, transfer of energy still is going through copper vires and main sources for

2. What is energy?

Energy makes change possible. Energy moves cars along the road and boats through the water. Energy bakes a cake in the oven, keeps ice frozen in the freezer, and lights homes.
Scientists define energy as the ability to do work. Modern civilization is possible because people have learned how to change energy from one form to another and then use it to do work.
Forms of energy
There are many forms of energy, but they can all be put into two categories:

- Potential energy
- Kinetic energy

Overview of each major energy source's impact on the environment		
Nonrenewable energy sources	**Renewable energy sources**	**Secondary energy sources**
• Coal	• Biodiesel	• Electricity
• Natural gas	• Biomass	
• Nuclear	• Ethanol	
• Oil and petroleum products	• Geothermal	
• Gasoline	• Hydropower	
• Diesel fuel	• Solar	
	• Wind	

3. Sources of energy

During the process of evolution human beans had face with need for different sources of the energy, in a last century in a world experts had developed and implement several technologies for this purpose. (Mandil) is stating that "***Technologies can make a difference***, *…. A sustainable energy future is possible, but **only if we act urgently and decisively** to promote, develop and **deploy a full mix of energy technologies** – **We have the means, now we need the will**" **Among** those technologies are:

a) Nuclear power plants
b) Coal-fired power plants
c) Hydro-power plants
d) Wind Power

Each of above mentioned technologies have its problem and benefits and most common thing regarding those technologies is that all of them need skilled and well trained people and all of them are having negative impact in the environment.

Nuclear power plants

Since the middle of the last century nuclear power plants are used to produce electricity. Strengths of using this technology are that the benefits exceed its cost and according (Bruno) "one nuclear plant cover the needs of several millions people". This technology it is not contributing in CO_2 emission. This technology is having also its problems. The main problem for nuclear plants still is remaining nuclear waste and as other problem is that of long lead time for construction and public safety perception regarding nuclear power plants.

The United States imports most of the uranium it uses as fuel, in addition owners and operators of U.S. nuclear power reactors purchased the equivalent of 56.6 million pounds of uranium in 2015. Only 6% of the uranium delivered to U.S. reactors in 2015 was produced in the United States and 94% came from other countries:

- 37% from Kazakhstan, Russia, and Uzbekistan
- 30% from Canada
- 17% from Australia
- 10% from Malawi, Namibia, Niger, and South Africa

3.1. Coal-fired power plants

Coal fired power plants are using follies like coil, in order to produce electricity. Those plants are contributing in global warming, according (RIT) "global surface temperature increased 0.74 ± 0.18 °C (1.33 ± 0.32 °F) between the start and the end of the 20th century". Also mining is difficult and dangerous process as well. Coal fired power plants need to have extra spare quantity of coils in order to fulfill customer demands for electricity.

Benefits from use of this technology are that Coal fired power plants can be built everywhere where it is possible to transport coil and those power plants can produce large quantity of electricity.
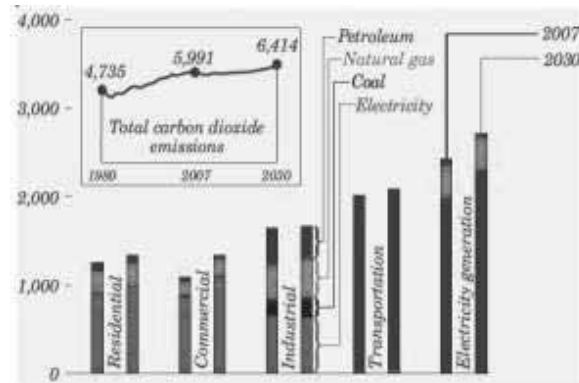
Figure. 1, Carbon dioxide emissions by sector and fuel, 2007 and 2030 (million metric tons)

3.2. Hydro-power plants

Regarding hydrogen economy (Veer) is stating that :"even given the most optimistic scenario for hydrogen, it may take another 40 years before hydrocarbons fully lose their dominance of the energy industry" but despite this fact according (wikipedia) 19% of electrical energy in a world is produced by hydro power plants. Advantages of this technology are that with this technology there is no waste or pollution, this technology is more reliable than solar or wind power and hydro-power plants may enlarge to full power very quickly. While problems which are opposing this technology are that the dams are large investments and building a large dam could flood large areas of land which will cause change in eco system and also it may reduce quality of water.
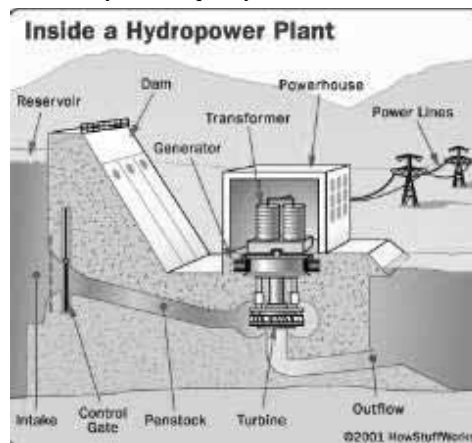

Figure. 2, Inside Hydropower Plant

3.3. Wind Power

Electricity is produced also from wind with use of turbines, which are very expensive and in a same time require a specific and expensive maintenance. Those turbines are making noise and taking lot of space and they are not convenient for urban areas. But there are also benefits from using this technology to produce electricity. Only in Europe during the year 2009, emission of 91 million tons of CO_2 is avoided with use of this technology (EWEA). Another benefit from implementing this technology is that wind is free so in order to produce electricity this technology is not burning any fossils at all.

3.4. The significance of needs of the US Navy and the perception of safety by the US general Public

(Morone and Woodhouse) Are stating that: "The scale-up and shift in safety strategy represented a critical juncture in the history of nuclear power". All this had started with introduction of light water reactors which are used in US navy submarines. Because of the circumstances, US navy had selected an economical reactor and didn't focus too much at safety. This was because in that time was only one military approach, and civilian or commercial approach to this issue was low. US navy was focused on creating economic reactors and their goal was to use those reactors in submarines. In the other way civilian sector had its concerns regarding inherent safety. (Morone and Woodhouse).

If reactor developers had focused in safety of reactors as they were focused in economical aspect today, we would have safe reactors which would work with minimal risks. Some initiatives had existed regarding this, for example in 1956 General Atomic had produced TRIGA (Training/Research/Isotopes/General Atomic) safe reactor which was distributed in hospitals, universities and institutions. But TRIGA reactors had had short product life because they didn't have large capacity for producing electricity.
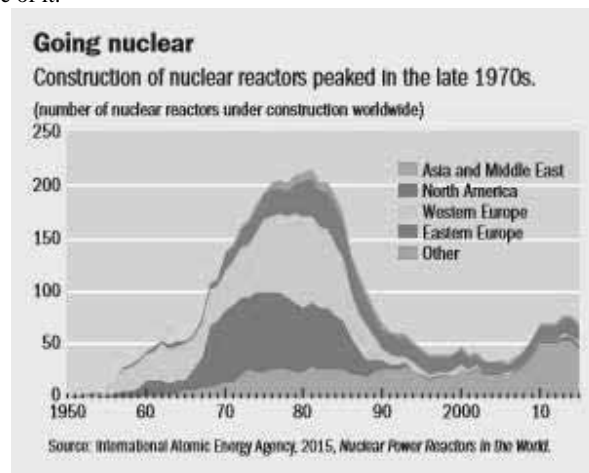
One decade later reactor producer had start to see the possibility of commercial use of nuclear reactors and for the first time they had started to think and to focus on safety issues. But all researches regarding safety were done on low capacity reactors (100 megawatts or less) and commercial reactors had had capacity from 100 -300 megawatts.   This had increase perception of safety by the US general public and if in that time reactor manufactures would focus more on safety today we could have different nuclear reactors and in general this technology would have different path of development.

(Morone and Woodhouse) As a characteristic of the American nuclear enterprise are identifying facts that it is based on competitive privately owned supplier industry. Because of this many companies had ordered nuclear reactors and then they had sold electricity to other companies or directly to their customers. But if we had had the case were nuclear power plants where publicly owned, development of this industry would have different path not only in the US but also in a world. Instead of having many small reactors in the US would exists couple of large reactors and there would be the risk of malfunctioning because in that time this was new technology. In the other way this would help standardization of this technology within US. For example, in US were four manufactures, each with different design and twelve architect-engineering firms competing and multiple sizes and periodically updated designs from each manufacturer.

If this technology was standardized than there will not be the cases where companies are ordering reactors and they don't have required skills and training to operate with those reactors and in a same time, there will be share of experience between companies which are within the same industry.

There was a series of protests held over the world to demand their governments to abandon the nuclear power since the Fukushima crisis. Media kept broadcasting previous accidents such as Ukraine's Chernobyl and the Three Mile Island accident in the United States. The public is increasingly afraid of another nuclear disaster and magnifies perception of risk toward nuclear energy. Despite the Japan accident, some countries (e.g. France, Korea, China) still regard nuclear power as a carbon-free energy source and approve of it.

Going nuclear

Construction of nuclear reactors peaked in the late 1970s.

(number of nuclear reactors under construction worldwide)

Source: International Atomic Energy Agency, 2015, Nuclear Power Reactors in the World.

Davis and Hausman (2015) But it still won't be easy for nuclear power. In addition to high construction costs, nuclear power faces other significant challenges. In North America, for example, natural gas is so cheap it makes it hard to justify any other type of power plant. You can build a nuclear plant and sell electricity around the clock, but still not make enough profit to pay for the plant

Nuclear electricity generation by top 10 countries, 2014
billion kilowatthours
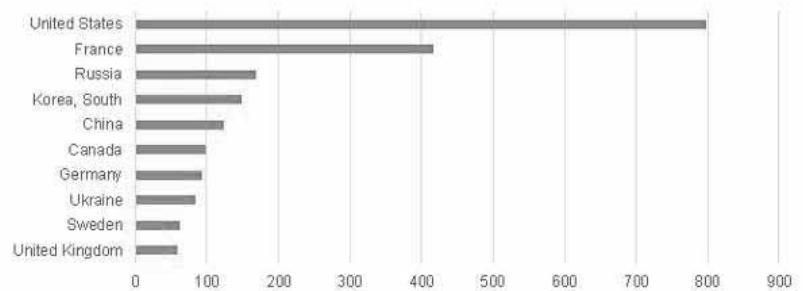
Source: U.S. Energy Information Administration

Conclusions

As well as the impact of the size of the nuclear plant, location might also impact on efficiency by attracting consumption and lowering the cost of transportation of the energy.

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Models for reducing power consumption in CPLD and FPGA devices

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Abstract. Usage of programmable logic devices PLD has increased in the latest years because of the ability to quickly implement complex types of electronic systems while reducing cost and time of synthesis. This technology enables dynamic reconfiguration of different applications according to specific requirements. Also, power consumption and its loss is becoming an increasingly important requirement in the design of systems for portable applications fed by batteries.

Other factors to be taken into account in the consumption of power are elements that are used for manufacturing, packaging, and cooling systems. Power consumption must be taken into consideration especially for wireless applications where battery technologies provide power 20 W/h and voltage 1.2 volts. Despite improvements in battery technology, the development of methods for reducing power consumption plays a decisive role in portable applications.

Therefore, modeling of power consumption has become a requirement with the highest impact in the performance of FPGA elements. Despite generated models of the different manufacturers of these elements, this article will appear comparisons of models based on experimental measurements performed on both CPLD and FPGA elements. Based on these models is selected to simulate a system that will be implemented in two elements and see how reduced power consumption, without affecting system performance. Experimental results show that FPGA elements have better performance and significantly reduce the power consumption.

Keywords: models, power consumption, CPLD/FPGA

1. Introduction

Recent years have seen an increase in the use of embedded systems, specifically in the field of electronics. This growing trend on the use of embedded systems is a consequence of very good performance and low power consumption are thus motivated to further research on advanced techniques for these systems. Many of these systems implement digital signal processing and require implementation of many mathematical calculations. Since digital signal processing (DSP) is already integrated into many devices it is necessary to achieve optimal designs to meet market demand. Software can enable flexibility in design, allowing continuous changes after design is complete. Software sequentially executed in hardware and allows sequential execution but in parallel. Also, the creation of integrated circuits for specific applications (ASIC) requires more time and after finishing it

is impossible to change the design. In this case they come to the aid of programmable logic elements, which provide a good solution combining hardware and software.

Digital signal processors have found applications in many areas of technology because of the short development time, low power consumption and low cost. Due to the design requirements of DSP systems programmable logic elements have become very necessary. Due to the development of fabrication technologies, FPGA contain many programmable logic blocks (CLB) and are becoming platforms suitable for a wide range of applications. Processors typically perform arithmetic operations through software, and the idea to realize these actions by hardware require a very long time to be designed. FPGA development platforms enable the best combination possible of both cases. Configurable hardware, such as FPGA, provides very high performance and therefore is faster than traditional microprocessors.

Finally, multiprocessor software technology use resources available in programmable devices. Based on their suitability and ability to support parallel, they serve as best platforms for fast prototype development and provide sufficient space for the design of complex systems.

Often these microprocessors can be implemented using FPGA as to enable reconfiguration when new functionality is needed. Digital signal processors performed by software should be simple architecture which provides good performance mainly to non critical calculations. In general, the FPGA can implement complex applications with high throughput, but the best performance requires high power consumption and this is the main challenge of today's electronic systems, especially in mobile devices [1-3].

2. Power consumption calculation

In this paper we focused on the aspect of physical-synthesis implementation of changes in logic circuits. The aim of these changes is to improve former county synthesis in order to significantly reduce dynamic power of it dissipates. In the following are some of the methods used for reducing dynamic power dissipated in circles Field-Programmable Gate Array. These methods use the theory to detect glitch probability and then apply techniques to reduce their use D-FF with negative triggered exit. These methods reduce number of logical transitions that occur, thus reducing the dynamic power dissipated by a logic circuit.

Most of the proposed techniques for reducing dynamic power at the regional level, including the establishment of a control logic that synchronizes entries logical blocks and reduce tension food sources [4]. At the logical level, the dynamic power dissipation achieved during synthesis and mapping technology [5, 6]. Rewiring up during synthesis reduces toggle rate of internal signals district, reducing the number of logic gates, the output of which toggles often and redundant gates are just added to reduce toggle.

Power dissipation consists of three basic components: static, short-circuit and dynamic. Static power dissipates when transistor current is flowing in even when it is closed. Static Power Static power is the power consumed by the FPGA when no signals are toggling. Both digital and analog logic consume static power. Short-circuit power is dissipated by a CMOS gate during a short period of time when pull-up and pull-down pass current. Dynamic power is dissipated whenever capacitor is charged and discharged in the circuit [7]. By experiments and surveys a FPGA with 4-LUT has power dissipation is 40% due to static power and 60% due to dynamic power [8] while the short circuit is negligible compared with the first two [9]. Dynamic power is the additional power consumed through the

operation of the device caused by signals toggling and capacitive loads charging and discharging. Dynamic power decreases with Moore's law by taking advantage of process shrinks to reduce capacitance and voltage. The challenge is that as geometries shrink with each process shrink, the maximum clock frequency increases [10].

Dynamic and I/O power dominate the FPGA's total power consumption. In Figure 1 shows the contribution of each component in FLEX10K and Spartan 6 elements. Power consumption distribution of the five elements forming a FPGA (Logic Cells, interconnect resources, clock tree, I/O cells and Memory cells).

Fig.1 Power consumption of each component

With I/O toggling at higher data rates and logic toggling at faster frequencies, the charging and discharging of loads on and off chip becomes the main consumer of FPGA power. To effectively reduce total FPGA power, both static and dynamic power must be addressed while ensuring the FPGA's performance still meets design requirements. Dynamic power consumption can be calculated:

$$P_{dyn} = \left[\frac{1}{2}C \cdot V^2 + Q_{short-circuit} \cdot V\right] \cdot f \qquad (1)$$

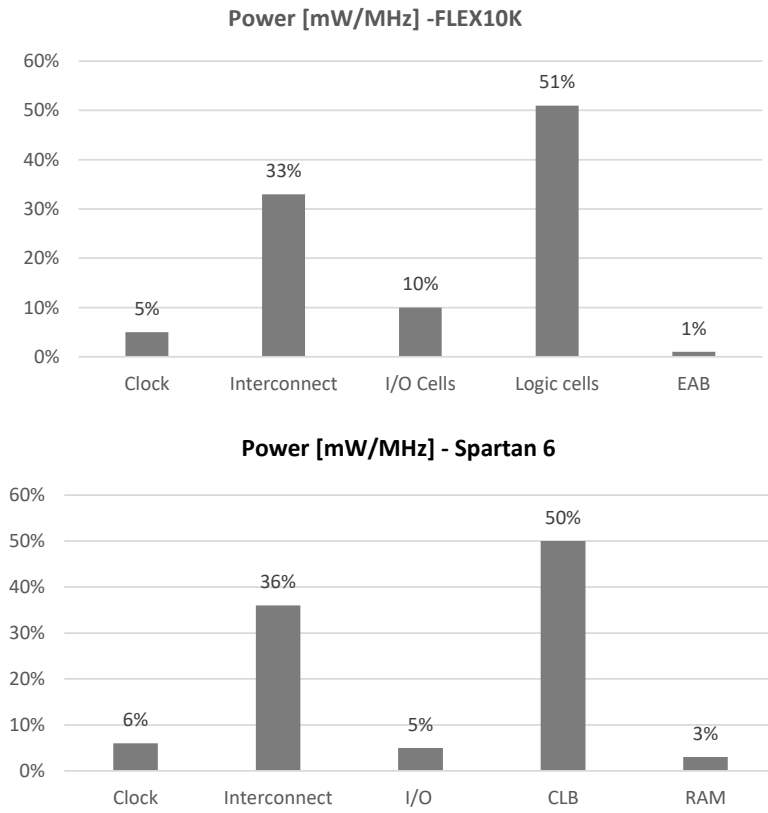Dynamic and I/O power dominate the FPGA's total power consumption. Because high-end FPGA designs tend to push the envelope in terms of bandwidth and performance, they use more logic running at a higher clock f. With I/O toggling at higher data rates and logic toggling at faster frequencies, the charging and discharging of loads on and off chip becomes the main consumer of FPGA power. To effectively reduce total FPGA power, both static and dynamic power must be addressed while ensuring the FPGA's performance still meets design requirements. The calculated average power consumption is expressed in the equation:

$$P_{avg} = \frac{1}{2} \sum_{i=1}^{nnumber\ of\ nets} (C_i f_i V^2)$$

(2)

where P_{avg} is the average value of dynamic power dissipation, C_i is the capacitance of the net, f_i is the average toggle rate and V is power supply value. It is important to use software tools that accurately predict the dynamic power consumption of a design. Unsophisticated power analysis tools simply model each circuit as a lumped capacitance. In contrast, Altera Power Play and Xilinx XPower Estimator are power analysis tools that use detailed dynamic power models: simulation-based power models and empirical power models.

3. Models for power consumption

In [11], gives a detailed power model that estimates static and dynamic power of the logic, routing, and clock network for a range of FPGAs with different architecture parameters is described. For static power, the model uses a first-order analytical technique which calculates leakage based on transistor size and various technology-specific parameters. For dynamic power, the model uses transistor-level capacitance information from the place and route tool and switching activity information.
In [12], a similar FPGA power model estimates static and dynamic FPGA power by calculating the power for each clock cycle using simulated switching activity information. This power model has been enhanced to support FPGAs with a programmable supply voltage and programmable threshold voltages.
In [13, 14, 15], high-level FPGA power models that use macro-models to estimate power are described. These models characterize the power consumption of various FPGA components, such as adders, multipliers, and programmable logic, for low power high-level synthesis. Based on this related works, in the explained models and the architecture of the programmable logic elements we have proposed to implement pipeline. First we have considered two pipeline structures: (1) 16-bit adder with a comparator and (2) between the adder and the absolute comparator, a stage of pipeline can be inserted after the adder. Apart the pipeline hardware implementation and I/O power supply we will focus also in the clock frequency parameter.

4. Experiment and measurements

Another factor is the majority of glitches were found on near-critical paths because they generally consisted of the largest number of LUT. For getting good results we used different designs realized

with Altera FLEX10K element and Power play analyzer estimation tool. Using a simple calculation of power, we see how small differences in structure affect a logical circuit. In this particular case the focus was on dynamic power dissipation of a logic circuit. Focusing on the problem, can locate and glitch nets can reduce the loss of their dynamic power. This estimate shows that this reduction in power consumption is achieved at the expense of increasing the delay to 3.23%. Experiments show that this small change in the structure of the circuit does not affect the operation of its logical and this technique can be used for optimization of power even in other elements of programmable logic. We have used an empirical calculation methodology used to obtain the current consumed by each internal sub-element of a CPLD/FPGA by starting with a simple design containing a minimum number of internal elements, fix toggling rate and constant room temperature. The static current measured for the Flex device is from 1.5 to 2.4 mA; and static current of the Spartan 6 devices is between 7.2 and 7.6 mA. The difference in the current consumption is computed to estimate the power consumed by this element. Interconnect must be the first to be measured because if the power consumed by interconnect is estimated first, then the power consumed by the others must be easily estimated.
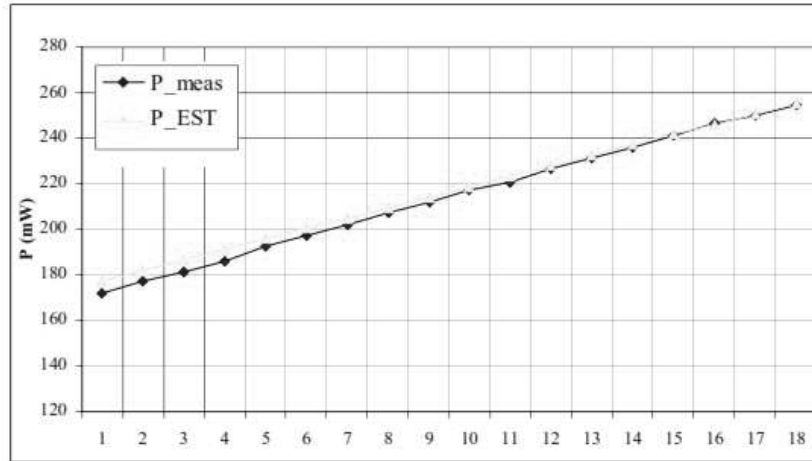

Fig.2 Power estimation and measurement for FLEX10K

After this measurement we have take in consideration pipeline and clock frequency 100 MHz, power consumption is measured for each supply voltage value from 5 volts to the minimum supply voltage is shown in the figure below.
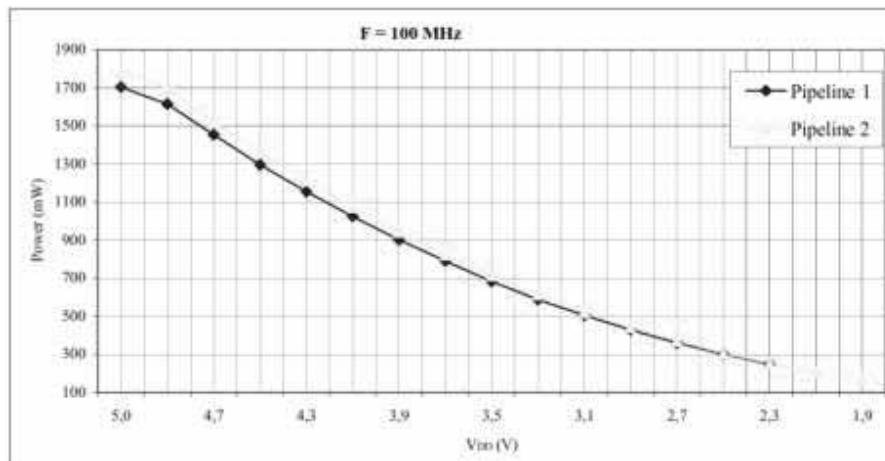
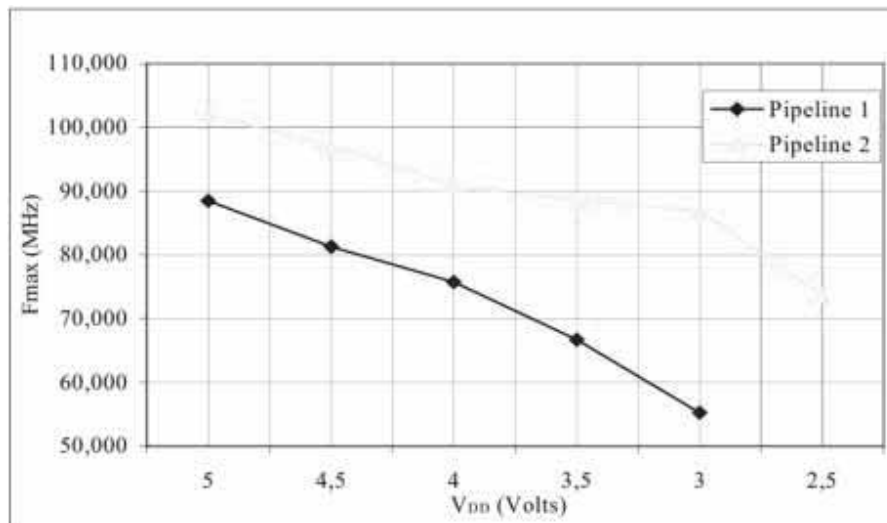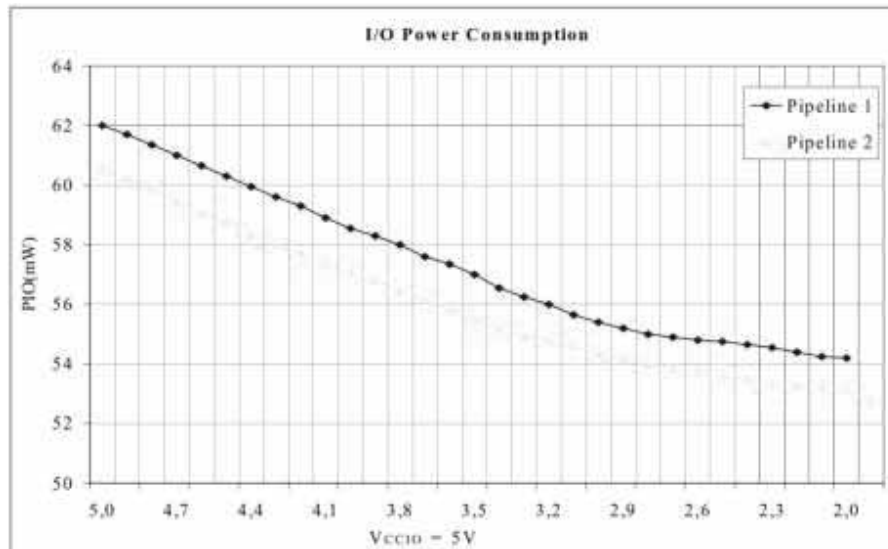Fig.3 Power consumption for pipeline architecture

Fig.4 Maximum clock frequency of pipeline architecture

Conclusions

This technique proposes the use of pipeline architectures coupled with very low supply voltages to save power in FPGAs without performance loss. In order to improve this, the minimum supply voltage and the most optimal pipeline have to be applied. The I/O power consumption is similar to logic power because it depends on switching, load capacitance, frequency, and voltage. By reducing any one of these components, one can reduce the I/O power. As we can see from the graphics, the right pipeline architecture implementation and the low power supply for I/O component can lead to approximately in a reduction of 5% of power consumption. Finally, the best technique for reducing power consumption is low power supply for the element but this change is possible only in fabrication.

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CLIMATIC CONDITIONS AND OTHER RESOURCES FOR KOSOVO TRANSITION TO "SES"AND HIS VISION

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Abstract. Developing modern technologies have made possible finding of alternative opportunities for exploitation of natural resources in order to meet the energy demands. Renewable energy is a good opportunity of meeting the environmental requirements and functioning of the applicable techniques system with an efficacy and efficiency using. Natural resources owned by Kosovo, with the main resource of coal as the only opportunity for energy generation, which is also the biggest polluter in the country has increased the requirements of continuous research, which of the types of energy (alternative energy) is likely optimal to be put into operation. Measurements, studies and ongoing researches on the efficiency of solar radiation, the effects of pollution of the fossils on the surface of solar panels, as well as the weather conditions as geographical position that has Kosovo, they have increased the presence of sophisticated techniques including the energy transition that the country is facing as a necessity generation. Measurement of solar radiation in some locations of Kosovo for the intensity of current and voltage, when the solar panels have been under contaminated aerosols and when the panels have been cleaned of particulate pollutants, as radiant efficiency in comparison of the data eliminates every dilemma of the exterior factors that requirements for use of renewable energy have occupied a special place in the world of developed technology. Climatic monitoring conditions for each contaminated element hold in themselves an hope for a practical advanced opportunity towards sustainable development that Kosovo has a favorable geographical position and favorable climatic conditions for solar energy and other energy sources to put in use a new energy strategy, including the opportunity to generate 100% of the clean energy.

Keywords: Climatic Condition, Effect of aerosol, Sustainable energy system, Reneveable Energy, Geografical postion.

1. Introduction

Management of data on air quality monitoring stations in a central electronic action, Establishment of new generation capacity according to the model RES of the EU Directives, Development of a visionary strategy for the future with 100% clean energy.

Based on the processes data of Kosovo Hydro metrological Institute and other institutions without dependent on research of natural resources table 1.

Table 1: Measuring intensity of current, voltage and solar radiation when panel is clean

Measurments of solar radiation when solar panels are clean in Prizren, Shtimje and Fushkosova							
Location	PV kWh/m²	Wind m/S	DC I (A)	DC V (V)	P (Wp)	t (ºC)	Month/2013
Prizren	1165,37	1,96	4,65	26,43	76,81	27	June
Shtimje	1189,23	2,31	3,2	28.88	74,26	24	June
Fushkosova	1210,34	2,56	2,95	25,92	77,55	30	June

Solar- analysis of solar radiation - Measurements of solar radiation with instrument MP 100 and MP 200 (Solar meter) and comparative analysis data of efficiently pollution aerosol particles[1].

Table 2: Measuring the polluting particles with aerosol effects

Without pollution / g/mm³	With pollution /g/mm³	Pollution particles / g/mm³	%
2.041435	2.323325	0.28189	12.13304
2.018494	2.209853	0.191359	8.659354
2.072691	2.127873	0.055182	2.593294
2.057633	2.256998	0.199365	8.833193

The quantity of water flows, spaces of water collection and possibilities of hydropower constructions based on Kosovo strategies and other research including the feasibility of international companies.
Measurement of polluting aerosol particles was done in Kosovo Hydro-Meteorological Institute in Pristina, through an international standardized electronic devices figure 1, type of device is CUBIS Sartorius MSA 225 S with 6 decimal point precision[2].

Figure 1: Instrument CUBIS Sartorius MSA 225 S in six decimals

CLIMATIC CONDITIONS AND OTHER RESOURCES FOR KOSOVO TRANSITION TO "SES"AND HIS VISION

Pollution particles collected for a photovoltaic cell module in Shtimje made by an instrument Sartorius Cubis. In continuation, we'll illustrate the measurement of particulate pollutants taken in samples for several periods at the same time and in different seasons[3].

Samples located in a closed bag of sterilized bandageü is measured without contamination expressed in grams (g), then, with the prepared pollution are collected pollutants in a solar panel in those places where panels are placed for public roads lighting in Shtimje, Fushkosove and Prizren. Measurements of particulate pollutants presented in Table 3 are related to different periods according to locations from the time when the solar panels for lighting of public roads are assembled[4,5].

Table 3: Presentation of monitoring air quality for Peja, Prizren and Obiliq

MONITORING OF AIR POLLUTION IN PEJA, PRIZREN AND OBILIC FOR						
Regions	SO_2(mg/m³)	NO_2(mg/m³)	O_3(mg/m³)	CO(mg/m³)	PM10(µg/m³)	PM2.5(µg/m³)
Peja	5.63	10.93	54.43	0.66	43.1	36
Prizren	6.98	21.65	97.7	0.75	50.3	35.5
Obilic	7.86	13.92	48.3	0.629	53.1	37.3

The conducted measurements related to poluting particles illustrate that Fushkosova is location with higher pollution, as well as Pristina with a large difference in % figure 2 by solar modules. Automatic monitoring stations with electronic data are located in several cities of Kosovo for measurement of SO_2, CO, NO_2, O_3, PM 10 and PM 2.5.
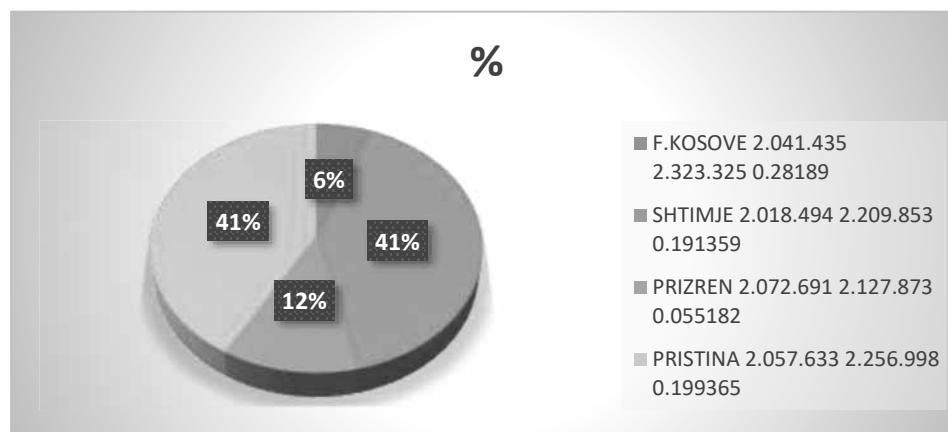
Figure 2: Polluting particles with aerosol effects

These results are derived for the first time, and they have never been processed and managed before. Kosovo lacks a center station regarding to data management, where the relevant institutions will be able to be informed with necessary data of the living environment, where natural resource can be used. The presented extraction of data from electronic monitoring station in Obilic for some types of

pollutions including aerosol particles from burning fossil. The TELEDYNE device, reffered as advanced pollution instrument, respectively ANALYZER – MODEL T 300 for monitoring of particulates PM 10 and PM 2.5 in Obilic, at the time of extraction of findings with electronic data [5,6].

The data of Kosovo Forestry Agency and possibility of exploitation of this natural resource

The data of thermal energy including studies case for the construction of high buildings and the case of research for the amount of Geothermal for residential buildings, also for areas where the water is heated deep and underground deep[7].

2. The vision of SES for Kosovo

The description of factual situation of Kosovo energy system based on:

Energy Corporation of Kosovo - KEK Generation of electricity from cool

Kosovo transmit ion system - KOSTT transmit ion of electricity- 400/220/110/35 kV / kV / kV / kV

Distribution and Supply of electricity- 35/10/04 kV / kV / kV.

The system for the future will be close the generation of burning fossil fuels (coal) to power plants Kosovo A and B, the vision of the future will be 100% renewable energy, with reducing emissions by looking at the zero value[8].

3. Vision of SES for Kosovo

Production of electricity from thermo power plant is 97% from both generation Kosovo A and B with burning fossils, the technology are old and with massive pollution above the allowed EU norm by Directive 2001/80/EC

Vision for the future - We need a transition to a new, sustainable energy system (SES), which will be durable and without GHG emissions. New system has to fulfill the following 6 criteria:

1. Energy source has to be unlimited and available everywhere on the planet Earth.

2. Energy carrier transformation should be without emissions of GHG.

3. Energy has to be available at all times in all needed energy forms (solid, liquid, gaseous, electricity)

4. New energy system should use existing infrastructure with minor adaptations;

5. In transition period both systems should work in parallel without disturbances.

6. Sustainable energy system has to be competitive with inclusion of all external costs in the price of fossil fuels [10].

4. Simulation of the Vision for-SES

Final energy is needed in industry, traffic and domestic, commercial and public use, with common designation „others".

We can cover those needs:

1037MW from RE in Kosovo can be covert on the end of year 2050 with nvestment in the following infrastructure:

• HE Zhuri 300 MW and small 27 Hydro power around 87 MW
• wind PP 300 MW
• 200 MW of geothermal PP
• PV PP capacity of 150MW (area for this ~55 km2) under present building stock in Kosovo is more than 271 km2. We need to cover only ~25 % of this area).
Using bio waste from forest and fields,
• Investment in geothermal heat, ect [11].

5. Environmental of consecuensicis of each scenario-

New Sustainable Energy Concept (SEC) and emissions of CO_2, NOx, Co, SO_2, Dust to be reduced in minimum. This mean that we have to replace 1137 MW in TPP with the new RE PP. With regard the nominal working hours this mean to build approximately 1.000 - 2000 MW installed power in solar, geothermal or hydro PP, including energy storage capacities.

Conclusions and further research needed

Available time to change is in the upcoming decades.
Proposed SES for Kosovo enable us to convert present fossil fuels based system to 100% RE up to 2050.
• Presented energy system is 100% sustainable.
Those energy carrier, including renewable electricity can use all present energy infrastructure in Kosovo (power and gas lines and pumping station).
Negative impact of this development is expressed in climate change [10-11].

Expected contribution for the science

The contributions are multidimensional, reduction of air pollution are in zero, for savings of Budget, No more energy import.
SES 100% RES energy.
To empowered the future generations to conduct the study for future

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RADIAL STRUCTURE GRAPH -BASED MATHEMATICAL MODEL FOR LARGE DISTRIBUTION NETWORKS

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Abstract. In the modern electrical distribution network and utility companies a steady increase in the need for high quality and safe delivery of electricity to consumers is evident, which requires an adequate distribution network, that is a network with high quality voltage and low loss of energy, with a small number of failures and equipment failure , etc. In this paper is proposed a way of representing the mathematical model of distribution networks. For calculations of energy applications, the best way for representation distribution network is in form of graph of the radial structure. By presenting the distribution network in the form of a radial structure graph, which consists of nodes and branches, possible through the use of specialized compensation algorithms for the calculation of steady state and fault analysis. Advantages of these algorithms, as compared to other algorithms are much shorter time needed for calculation and much higher accuracy of calculation results.

Keywords: Distribution Network, Distribution Management System, Model Topology Service, Bus / Branch model, Mathematical Model of Distribution Networks.

1. Introduction

In the modern electrical distribution network and utility companies a steady increase in the need for high quality and safe delivery of electricity to consumers is evident, which requires an adequate distribution network, that is a network with high quality voltage and low loss of energy, with a small number of failures and equipment failure etc. [1-2]

That quality of electricity supply can be ensured by investing in expensive power equipment and by applying significantly less expensive automation equipment and sophisticated systems to automate the management of distribution networks. The most sophisticated advancement is Distribution Management System (DMS). As an industrial product, the DMS is still in development. [1-2]

This system provides a very high quality performance of all technical tasks in distribution companies: surveillance and control, analysis, management, operation and development planning of distribution networks, etc. DMS represents a software platform based on a set of applications and services necessary to ensure the effective functionality of distribution networks and consumer companies in order to achieve a secure electricity supply at minimum cost. [1-2]

The system of energy applications, is based on a set very complex algorithms and mathematical procedures, and is certainly the most important component of DMS. The complexity of these procedures is a result of the very large size of the distribution network, a strong sense of uncertainty of data, a small number of data on the current situation and so on. The basis on which all energy applications rely presents a mathematical model of the distribution network (DN).

Mathematical model of the network processes the static data elements of the network and slow changing variable data (status of switching equipment) to determine the topological structure of the distribution network considered. Number of entities in the power system is large, resulting in the application of algorithms for topology modeling, affecting the speed of calculating energy applications. In the paper, a bus / Branch network model is used, which has no information about switchboard equipment, measurements and other details. This model was implemented by using object-oriented methodologies. The key features of this methodology are inheritance, aggregation, association and polymorphism that give better software implementation.

2. ARCHITECTURE DMS

DMS application, generally speaking, make the following system components (subsystems):
• Graphical User Interface (GUI) - customers who represent presentation level
• DMS server that represents the level of the application
• Historical data representing the level of the database.
DMS application server consists of a series of independent software services that interact together and give a response to the input that can be a customer requirements and changes in the state of devices in the field. Each of these services is independent with its internal representation of the physical system, providing an interface for interaction with other services. Services are divided into several functional groups, as shown in Figure 1. [3]
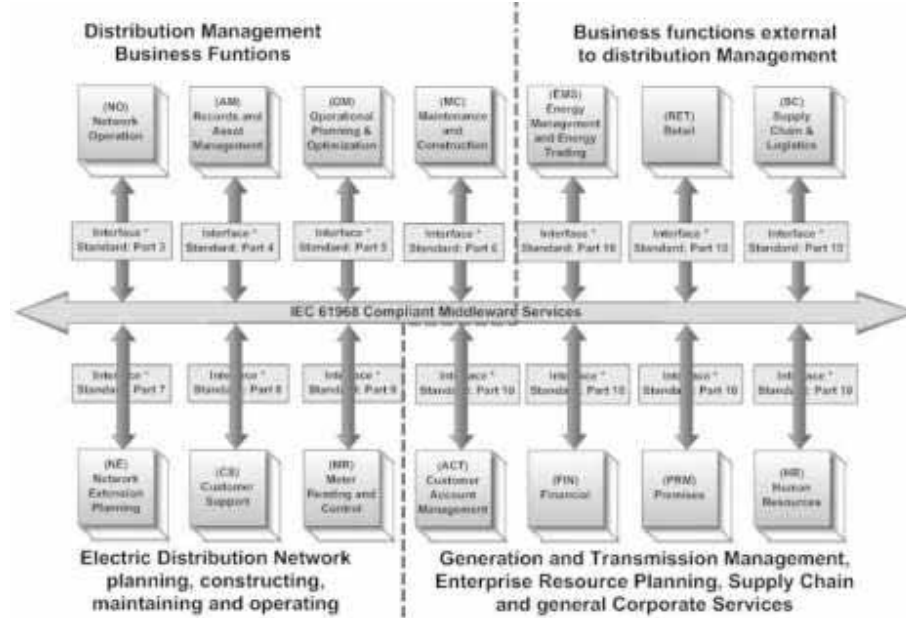
Figure 1. Architecture DMS [4]

All services together constitute a single context. The context is a set of data and services abovehim that are working over a state. It allows the operation of DMS in a safe and quick way. Context can be:
• Operational - when the connection to SCADA system (DMS Real Time)
• Simulation and
• Context for testing and data entry.[2-3]

3. Model Topology Service

Model Topology Service (MTS) is a service that is responsible for the creation of a mathematical model. It contains a representation of a power distribution system, which is based on the current state of the switching equipment. This service connect's together static and dynamic information about the elements. Data elements are placed in appropriate vectors. MTS when determining the topology it creates an internal model to be used in a variety of DMS calculations. [5]

3.1. The internal model

The model is the basis for all energy functions, because it contains all the network information presented in the form of a graph. Graf DN consists of:
• nodes,
• branches,

• shunts.

These elements of DN are interconnected across the field, and are collectively referred to as the ends of the field. Fields are complex elements that are essential in the formation of the graph, for connecting and contain all the other elements DN: switching equipment, measuring and protective devices and so on. The fields and ends fields are elements of a graph. Facilities of the power system in the internal model are presented with classes and relationships that exist between these classes. Only basic classes that are used to create an internal model are shown in Figure 2.
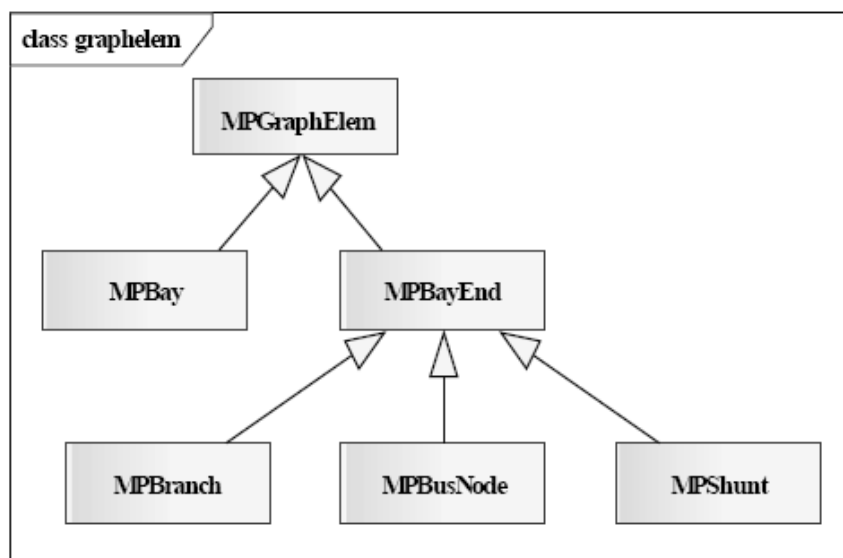

Figure 2 elementary classes of the internal model

There are clearly defined rules by which the elements of the graph are connected. They are given the following table. Each + sign indicates a permissible connection. [5-6]

Table 1 - Possible connections between elements MPGraphElem

	MPBay	MPBusNode	MPBranch	MPShunt
MPBay		+	+	+
MPBusNode	+		+	+
MPBranch	+	+		
MPShunt	+	+		

3.1.1. MPGraphElem

Class MPGraphElem models elements of the graph of the distribution network. This class uniquely identifies each element modeled in the internal model. It also contains an attribute phases, which determines the phasing element and represents the structural information of each element. Elements of the graph form fields and elements that are connected across the field, the so-called end of the field.

3.1.2. MPBayEnd

Class MPBayEnd inherits class MPGraphElem. It represents the base class that models the ends of fields: nodes, branches and shunts. The class has an attribute phaseMarker that determines active phased elements, or those stages that are energized.

3.1.2.1. MPBranch

Class MPBranch inherits class MPBayEnd. This class models a branch graph DN. Branches are forked. The graph network, it is located between two nodes. The attribute endNode [2] refers to the objects of class MPBusNode. These are the nodes from the ends of the branches, which can be seen in the graph network. The first node of a series is always filled with a knot that is closer to the source, and is called the overhand knot.

A node branches which is farther from the origin is called the lower node, and it is to be completed by the second element of the array endNode. The most important class derived from the class MPBranch MPSection and MPTransformer. Class MPSection modeles the section, and the class MPTransformer two-winding and three-winding transformers.

3.1.2.2. MPBusNode

Class MPBusNode inherits class MPBayEnd and models the nodes of the graph. The attribute neighbors presenting the author vector elements graph incidents given node. The attribute parentChild presenting the author vector fields over the incident given node. It differs from the attribute neighbors, because it does not contain fields. This vector is filled during processing topologies and provides fast and efficient access to branches incident node that is observed.. Depending on whether the node branches further or closer to the root of the network, a branch of the parent or the child branch of a given node

3.1.2.3. MPS hunt

Class MPS Hunt inherits MP Beyond and modeled the following elements: a generator, motor and capacitor. These elements are collectively referred to as shunts.

3.1.3. MPBay

Class MPBay is derived from the class MPGraphElem. This class models the fields that connect the ends of the field. Each field has its own internal and external elements. The external elements are of the end of fields and represent objects of class MPBayEnd. Ends attribute contains information about the outside end of the field. The attribute equipment contains information about internal elements fields. Internal components are modeled class MPBayEquip. They make the equipment:
• switching devices,
• measuring transformers (voltage and current)
• fault detectors,
• relays,
• Surge venters.

3.2. Navigate through the network

Network Elements, on the basis of which creates an internal model, are placed in appropriate vectors. These vectors have the following characteristics:
• very quick access elements,
• ability to efficiently add / remove element,
• abilities copying elements.
For very fast access to these for efficient movement through the network, are defined classes and their methods. representing the so-called iterators. There are several different classes, suitable for processing network elements and pass through the same. These are:
• DownScanner
• ShuntScanner
• ScanIterator
• DownIterator
• UpIterator
• ContourIterator
• AllIterator.
Each of these classes has defined methods Begin and Next. The most important class of these groups is the class DownScanner. [7]

3.2.1. DownScanner

Class DownScanner carries a move through the network in a given direction, by Layer. This iterator leads over any other, carrying out preparation for updating the data elements given network, after which enables the use of other iterator. For this reason, it is much slower than the others, thus, is not used in energy functions. Reference is made in the processing of network topology for all roots detected islands. DownScanner while passing through a network it observers' vector neighbors for each node, while other iterators use vector parentChild. Before processing topology vector neighbors is only filled while the vector parentChild updated on the basis of the evaluation program. Due to this, iterators can be used after a call scanner, or after processing the topology.

3.3. The topology analyzer

The topology analyzer, (processing topology) runes topological analysis of the current status using class DownScanner and internal model. Based on the status of switching equipment static elements of the network topology analyzer represents the distribution network in the form of a graph that represents the input for each energy function. Updating changes in the graph of the distribution network that are the consequences of changing the status of switching equipment or installation of a new element in this network, topology analyzer can be divided into two parts:
• processing topology by roots
• processing topology the islands.
The first deals with all the roots, and then detected the island.[7]

CONCLUSION

By presenting the distribution network in the form of a graph of the radial structure, which consists of nodes branches, enabled the implementation of specialized algorithms for compensating calculation of stationary regime and fault analysis. Advantages of these algorithms, as compared to other algorithms for the calculation of the regime in the distribution network, are much shorter time needed for calculating and a much higher accuracy of the calculation results. These benefits of compensating algorithms in particular are manifested when increasing the number of nodes that are part of the graph of the distribution network. Since the calculation of the function of the stationary regime and fault analysis form the basis for the work of all other energy functions, "Mathematical model" is a function that ensures compatibility integrity of the system energy applications

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Physical-Chemical characteristics of the Substances Before and After the discharge of factories of the detergents that can cause increase of the degree of the eutrophication of surface waters in the city of Prizren

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Abstract. Industrial discharge waters, especially those of producers of detergents are one of the main polluters of surface waters in Prizren. The greatest polluters are: vehicle laundry and laundry of mega clothes, as well as factories producing liquid detergents, as well as powder ones. Concentration of active substances and perborate polyphosphate detergents also increase the wastewater from households. Therefore, we can say that the washing detergents, cleaning, are not safe for the environment, all of those are in varying degrees dangerous pollutants. Their presence represents the most acute problem of water supply in the city of Prizren. In this paper are treated physico-chemical indicators of pollution that may be caused by emissions from factories producing washing substances in the region of Prizren, Kosovo. And especially, will be treated contaminants from the manufacturing industry to washing agents, whose production due to massive use causes the polluting of current waters. This has happened because they have not paid attention to the chemical and physical- chemical features of phosphates and other compounds that affect eutrophication of Lumbardhi River. The problem of eutrophication also represents a form of disruption of the ecological balance of nature and consist with increasing phosphorus compounds in waters, where it causes the rapid development of the planktons and algae, causing damage to water quality. The Microbiologic problem of dissolution of tensids even at low concentrations causes creating dense and stable foam in waters surface, which prevents digestion of oxygen from the air into the water and thus the question of the survival of flora and fauna in those waters of the river Lumbardhi, as well as its use for drinks. This problem is caused by the wide use of detergents that contained tensids with branched range of hydrocarbons, which as the main representative is dodecyl benzene - sulfonate of tetramer type.

Keywords: detergents, tensioactive substances (LAB-sulfonate), total phosphorus, sodium tripolyphosphate, sodium perborate.

Physical-Chemical characteristics of the Substances Before and After the discharge of factories of the detergents that can cause increase of the degree of the eutrophication of surface waters in the city of Prizren

1. Introduction

The river Lumbardhi runs along the midst of Prizren city. The main sources of this river are those of Mount Lumbardhi, height 2640 m[8]. The urban area of Prizren has potential for water pollution in many ways. This way, from the street, the carriers of pollution are vehicles, such as tires, oil, heavy metals, various oils and other ways of contamination. Untreated sewage or poorly treated can influence the reduction of dissolved oxygen value and this leads to increased fecal contaminants like bacteria, nitrates, phosphorus and other chemicals. In this paper will be treated and evaluated experimentally the river pollution rate of Lumbardhi from the discharged pollutants from the urban area, especially from the manufacturing factory of detergents "ABI". The slogan "Chemistry in our everyday life – washing agents" includes basic and general knowledge of the washing agents for the public as a whole and emancipation of consumers about the effects of ecological possibilities of alleviating the negative impact of washing agents in our environment where we live[3].

Waters, under natural conditions (unpolluted), have relatively low content of phosphorus; in these cases, the water view is sober, less or no vegetation and the end of the river is clean. This water is named "oligotrophic". But, eutrophic waters are green in color, dim and viscous as well as their translucency is low.

Therefore, there are attempts to find an adequate replacement of phosphates in various detergents formations. A biological control of roads is reducing the amount of phosphorus in water through special pools in which are cultivated algae, which can be used as animal feed. However, eutrophication is a complex process, which can not only be linked to a harmful substance (e.g. phosphorus) but from a range of harmful substances (manganese, iron, ammonia, silica, etc.). Therefore, the elimination of only one substance is not the solution of this problem, especially if it is only for a pollutant, as is e.g. industry of washing agents.

And every European country has their own internal regulations on the maximum amount of phosphates that should contain detergents and in some countries it is illegal to use detergents with polyphosphate but only with zeolite

In Kosovo, there are no treatment plants of urban waste water and industrial waters. Industrial waters are one of the main polluters of surface and groundwater. Treatment of discharged urban wastewater and industrial ones in Prizren areas in fact are non-existent, with the exception of some septic tanks for household restricted areas or natural lagoons which are formed in the points collection systems discharging wastewater.

Wastewater discharges constitute the main source of pollution of natural waters because they contain many substances that consume dissolved oxygen: soluble phosphorus compounds (eutrophication), and detergents that affect water quality. In terms of management of wastewater, Kosovo will face major challenges, particularly in relation to the implementation of EU directives (Directive 91/271 / EEC on treatment of urban wastewater) and the fulfillment of international obligations. This given the fact that Kosovo's rivers pass through neighboring countries. However, Kosovo still does not have a strategy for managing wastewater and creating functional mechanisms for the financing of waste water treatment.

2. Material and methods

Sampling of water for laboratory analysis is done carefully. In this paper we are dealing with water sampling: those virgin ones, water discharge channels for the manufacturer of detergents and water sampling of rivers, always respecting the following rules and based on standards. So, according to this technique should be excluded a possibility of contamination from the outside; from the person who takes the sample or any other factor[4].
During sampling an important role had meteorological factors that should be recorded depending on the time interval.
Meteorological factors are:a. Time (sunny, rainy, snowy, etc.); b. Temperature;
c. Time and d. The water temperature of the sampling point[6].
Sampling for analysis in the scientific work is done in the time interval from September to October 2016.
The purpose of obtaining the sample is collection and sending water samples for laboratory examination. Sampling method is important as well as laboratory analysis. Therefore, and utmost care should be made in order not to contaminate the obtained samples during transportation to the respective laboratory for physical-chemical and bacteriological analysis. Bacteriological analysis is intended to show whether water contains micro-organisms harmful to health and are indicators for further processing and disinfection of drinking water. Chemical analysis shows the amount of needed chemical ingredients and harmful ones in drinking water[7].

2.1. Sample

Samples for laboratory analysis for determination of the physical - chemical "AB" are done at four locations (site-sampling) fountain-head (the water supply of the city, virgin samples) marked with AB1, drain pipe (water after the production process) marked with AB2, the drain pipe into the city sewage marked with AB3 and into the sewage before discharge into Lumbardhi of Prizren marked with AB4.
Samples are taken in time intervals:
- AB1 – fountain-head: on 06/10/2016 at 12h 20 min. sunny weather.
- AB2 - drain pipe: on 10/06/2016 at 12h 30 min. sunny weather.
- AB3 – drain pipe into the city sewage: on 10.06.2016 at 14h and 05 min. Sunny weather.
- AB4 - Sewage before discharge into Lumbardhi of Prizren: on 10/06/2016 at 14h 35 min. Sunny weather.
 Analysis of the samples were made in the laboratory of the Hydro Meteorological Institute - Pristina. In the following figure is shown the map of the sampling points of the "AB".

Physical-Chemical characteristics of the Substances Before and After the discharge of factories of the detergents that can cause increase of the degree of the eutrophication of surface waters in the city of Prizren

Fig. 1. Presentation of four site-sampling of "AB" on the map of the territory of the Municipality of Prizren

2.2. Results and discussions

The results obtained from the manufacturer of liquid detergents "AB" of Prizren are presented in the following table. From the sample were done three analysis and the average is calculated. The final results are given in the following tables, where are shown physical and chemical characteristics.

Table 1. The final results of the experimental analysis (September-October 2016)[5]

Parameters	Symbols	Units	AB1	AB2	AB3	AB4
Physical Parameters						
Time	00:00	h	12:20	12:30	14:05	14:35
Weather	Weth.	Observe	Sun	Sun	Sun	Sun
Weather	Weth.	Observe	Sun	Sun	Sun	Sun
Water Temperature	T_w	^0C	18.6	20.7	19.5	17.0
Chemical Parameters						
Hydrogen ion concentration	pH	0-14	7.48	7.22	6.87	7.19
Ion phosphate	PO_4^{3-}	mg/L	0.0038	2.372	2.288	1.203
Total phos.	Ptot	mg/L	0.021	1.127	0.329	0.982
Phosphorus	P_2O_5	mg/L	0.00	1.403	1.22	1.534
Sodium Tripolyphos.	Na_3PO_4	mg/L	0.0	2.42	2.11	2.65

Table 2 Allowed limit values of parameters in effluent that can be discharged into water body or public sewage system and maximum allowed values by the Kosovo Administrative Instruction for drinking water, MAV (maximum allowable value) and categories of pollution are marked with K. --- ADMINISTRATIVE INSTRUCTION No. 2008 on limit values of effluents discharged into water and public sewage network.

	Nj.	K. II	K. III	K. IV	K. V	K. VI	Virg. Wat.MAV
Ion phosphate PO_4^{-3}	mg/l	1,0	2,0	3,0	4,0	-	4.5
Phosphorus Pentoxide	mg/l	2.3	4.6	6.9	9.2	45	10.3
Tripoly- phos Na	mg/l	3.9	7.9	11.9	15.9	77.8	17.8
Total phosph.	mg/l	1,0	1,0	1,5	2,0	10,0	1.5

Explanation: In this table on the KII-KV pillars are given the values of the parameters by categories for the wastewater discharge and on the last pillar KVI are given maximum values allowed in the public sewage network for drinking water.

2.3. Ion of phosphorus concentrations and tripolyphosphate polluting detergents ingredient at the site-sampling "AB"

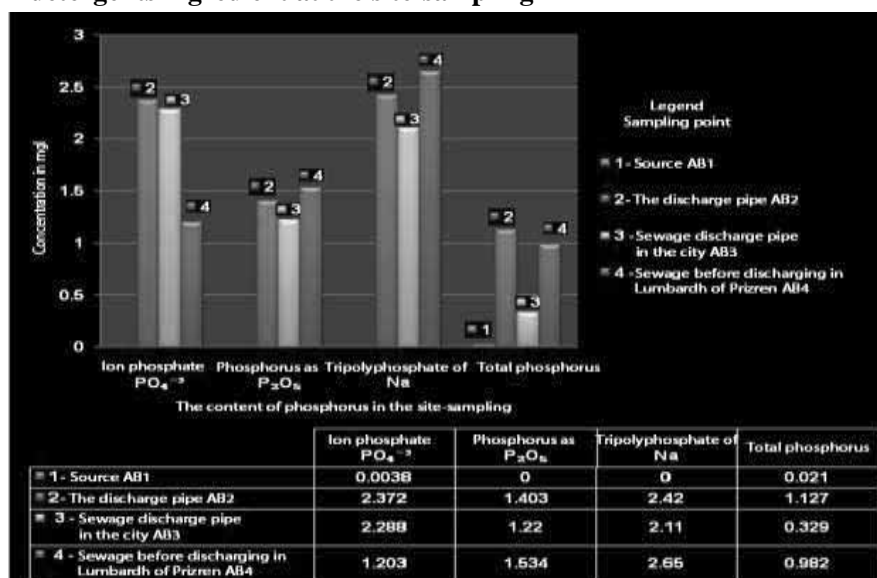|	Ion phosphate PO_4^{-3}	Phosphorus as P_2O_5	Tripolyphosphate of Na	Total phosphorus
1 - Source AB1	0.0038	0	0	0.021
2 - The discharge pipe AB2	2.372	1.403	2.42	1.127
3 - Sewage discharge pipe in the city AB3	2.288	1.22	2.11	0.329
4 - Sewage before discharging in Lumbardh of Prizren AB4	1.203	1.534	2.65	0.982

Fig.2. Graphic presentation of phosphorus concentration (September – October 2016)

Physical-Chemical characteristics of the Substances Before and After the discharge of factories of the detergents that can cause increase of the degree of the eutrophication of surface waters in the city of Prizren

Table 3. Comparison of the values obtained at the sampling points with MAV - WHO (September-October 2016)

First sampling point		
Chemical Parameters	**Source AB₁ – Obtained values**	**Categary II MAV**
Ion phosphate PO₄⁻³	**0.0038**	**1.0**
PhosphorusPentaoxide	**0.0**	**2.3**
Sod.Tripolyphosphate	**0.0**	**3.9**
Total phosphorus	**0.021**	**1.0**
According to MAV the sampling point belongs to the second category, low values of joint phosphate and total phosphorus at the virgin sampling point comes due to the consist of apatit mineral in the water source.		
Second sampling point		
Chemical Parameters	**Exhaust pipe AB₂ – Obtained values**	**Cat. Accord. to MAV**
Ion phos. PO₄⁻³	**2.372**	**3.0 (Cat.IV)**
Phosphorus Pentaoxide	**1.403**	**2.3 (Cat.II)**
SodiumTripolyphos	**2.427**	**3.9 (Cat.II)**
Total phosphorus	**1.127**	**1.5 (Cat.IV)**
According to the MAV – WHO, parameters ion phosphate and total phosphorus belong to the fourth categ. And phosphorus pentoxide and sodium tripoly phosphate belong to the second category, there is a serious pollution because manufacturing washing waters contain high concentration of detergents.		

Third Sampling point		
Chemical Parameters	**Exhaust pipe into the city sewage AB₃ – Obtained values**	**Cat. according to MAV**
Ion phos. PO₄⁻³	**2.288**	**3.0 (Kat.IV)**
Phosph. Pentoxide	**1.22**	**2.3 (Kat.II)**
Sod.Tripoly phos	**2.11**	**3.9 (Kat.II)**
Total phosphorus	**0.329**	**1.0 (Kat.II)**

According to allowed values from MAV, Ion phosphate parameters that belong to the fourth cat. and phosphorus pentoxide and sodium tripoly phosphate that belong to the second cat. there is a serious pollution due to manufacturing washing waters contain high concentration of detergents.

Fourth sampling point		
Chemical parameters	**Swage before discharge into Lumbardhi of Prizren AB_4 – Obtained values**	**Cat. according to MAV**
Joni fosfat $PO_4^-{}_3$	**1.203**	**2.0 (kat. III)**
Pentaoksidi i fosforit	**1.534**	**2.3 (Kat.II)**
Tripolifosfati i Na	**2.65**	**3.9 (Kat.II)**
Fosfori total	**0.982**	**1.0 (Kat. II)**
According to the allowed values from MAV sampling point shows pollution.		

Referring to the data in Figure1 and indicators in Table 3:

✦It is concluded that the concentration of phosphorus is too high into the drain of manufacturer of liquid detergent "AB" (AB2) and the discharge pipe into the city network sewage (AB3), due to the discharge of water after the production process. The main contributor to pollution of the waters is the detergent, in which sodium tripolyphosphate is used, which hydrolyzes slowly into water to form orthophosphate.

✦It is concluded that into the sewage before discharge into Lumbardhi (AB4) there are decreased values of these parameters, which represents pollution.

Conclusions

Based on the methodology in the study, we think that we have achieved in to determine the qualitative and quantitative water pollutants of discharged waters of detergents manufacturing factory AB into Lumbardhi. From the observation of our results as well as further monitoring shows that these discharging waters are not preliminary treated before discharge into Lumbardhi of Prizren.

✦ Referring to the rates of the maximum values allowed by the of the EU directives and comparing them with our data, we can make the classification of the quality of discharging waters in our country. During physical chemical analyzes of the quality of the samples taken in the joint sampling sites, there are variations of joint phosphate, pentoxide phosphorus, sodium tripolyphosphate and total phosphorus.

✦During our study we managed to make a comparison of our results obtained from physical- chemical analysis of water quality in sampling points which shows that the values of chemical parameters are larger at discharges from urban sewage network where it has its portion the detergents production factory AB into Lumbardhi River of Prizren.

Physical-Chemical characteristics of the Substances Before and After the discharge of factories of the detergents that can cause increase of the degree of the eutrophication of surface waters in the city of Prizren

✦According to the obtained results, the chemical parameters of joint phosphate, pentoxide phosphorus, sodium tripolyphosphate and total phosphorus and through the
discussion of these results, resulted that these values are greater in Lumbardhi Prizren River. Just as we showed above, this comes from multiple sources of wastewater discharged into Lumbardhi and lack of pre-treatment plants before they are discharged into it.

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The Neutralization of Water Polution

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One of the biggest sources of pollution land and water are industrial waste waters.

At section of zinc industry in complex Trepca during the process of zink production acquire(are gained or obtained) wastewater where their negative impact is wider extent of contamination of land with which it comes in contact and in this case comes to the accumulation ions of heavy metals, surface-water and then mixing with groundwater and pollution.

Directly with vulnerable is Sitnica river, in which contaminated water flows from the industrial unit for the production of Zn, which flows into the Ibar river, which still flows into the Morava river in Serbia, thus presents a problem internationally.

The objective of the paper is concerned with the characteristics of industrial wastewater from the section of zinc in Trepca complex and their impact on water pollution around.

Are made quantitative and qualitative analyzes of samples of polluted water before and after the production process and is found high content of ions of heavy metals such as: Pb, Zn, Cu, Fe, Cd, Bi, Ni, Co, Sb , Sn, etc., and which exceed the values of MLD,provided by international legislative rules. Neutralization is made of industrial wastewater based on the pH value and concluded that the water is rich belongs to the category of IV water according to legal regulations for water.

Keywords: Neutralization, wastewater, contamination

Entry

Natural water is clean and basic and indispensable element for human life, plant and animals, so is the principle that all the inhabitants of the planet to care for the exploitation and protection of his right.

Population growth and rapid development of society in terms of technological industry and has lead to enormous exploitation of water resources as well as to excessive pollution of water (surface-and groundwater).

In recent decades, as locally and internationaly importance that special attention is paid to cleaning of industrial wastewater, in order to improve the level of water pollution.

A special emphasis is paid of: equipment, automation for the processing of wastewater with dosing reagent then high frequency of cleaning of metal ions with slaked limes, eligibility and elements present in the molten.

Water that is used in technological processes for the production of metal is actually contaminated water. The degree of contamination depends on the amount of waste that water contains.

While matter pollutants coming from industrial units, then it comes to industrial wastewater, while if they come from more than urban households having then it comes to municipal wastewater. So that these waters back in kind and used again they must undergo purification process, which is performed through mechanical methods, chemical and biological.

Chemical methods for purification of water mean water purification process, which is based on chemical reactions and physico-chemical phenomena. Chemical process for the purification of water is very costly, but for cleaning the impurities present in the water some chemical process is no alternative.

As a base chemical cleaning process of polluted water from some solvable matteries is: With chemical precipitation with   ion exchange,gas blow   oxidation and   adsorption.

Industrial wastewater resulting from the different sections of the technological processes, but as their common characteristic is the high degree of toxicity receptors.The toxicity of these waste water is expressed by the degree of acidity and alkaline in the presence of a number of heavy metals, phenols, mineral oils and detergents, and in

Technological process for the processing of industrial waste water

Equipment for processing of industrial wastewater with neutralization process are intended for: receiving, neutralization and water purification, as well as filtering waste from contaminated water.

Liquid waste which come from different sections collected in the basin 93 VE 93 16. One of pumps PP 18 A / B made pumping in tank for neutralization in 93 VE 18 A / B that are located at cascade mood Slaked lime obtained from the processing of qiuck lime, which is transported through track and is stored in the bunker 93 BN 10. And slaked lime through ekstraktor 93 CV 11, with the help of pneumatic valve , drawn and with spiral transporters 93 CV 12 forwards so booked for the preparation milk lime, where the reservoir is equipped with agitator 93 VE 13.

Measurer level, through the contactor with the upper and lower part, made the opening for the supply of lime and water when the lower level is reached and interrupt when the upper level is   reached.

Preparing thus becomes the lime with 10% Ca (OH)2 . Specific weight of hydrated lime optimal adjusted based on experience.

The injection of lime made in two reservoirs, so that neutralization is done in stages, at pH 4-5 in the reservoir 93 VE 18 and at pH= 7 in   the reservoir 93 VE 18 B.

The third reservoir for flotation   93 V 20 also is placed in cascade mode compared with the reservoir93VE18A/B.

Reagent for flokulim, FeClSO4, preparation mechanically with 10% to rezervoir 93 VE 22 andwith the aid pump for dosing PP 93 24 A / B, the flow of which is regulated mechanically and sent to the reservoir 93 VE 20.

In cases where the pH value measured in the reservoir 93 V 18 B is low, then through a tube contaminated water turn in the basin 93 VE 16 through automatic valve which is located at the outlet of the reservoir 93 VE 20.

The solution whose is added flocculant(layer) through gravity sent to precipitation 93 TN 29. We added at supplier cylinder of precipitator polyelectrolyte which serves as a catalyst for precepitation.

This polyelectrolyte preparation mechanically by 0.1% in the reservoir 93 VE 26 and injected through a dosing pumpe PP 93 28 A/B, where the flow is regulated mechanically.

The clean neutralized solution flow from precipitator with gravitation and goes to the river.

Precipitate collected at the end of precipator passes through the reservoir to homogenise 93 VE 31, and with the help of a membrane pumpe PP 93 32 A / B pumped into the filtration equipment. Obtained precipitate undergoing processing, while filtrate goes into the river.

In Fig.1. The following will be presented technological scheme of industrial waste water processing (section 093).

Experimental Part

The degree of efficiency during precipitation of heavy metals depending on the pH value of industrial waste water processing of zinc metallurgy

Practically is confirmed that the process of cleaning wastewater with slaked lime in the form suspension is economical. The reason of process to processing with slaked lime based in the fact that most metal ions precipited in the form of hydroxides, where the rate of precipitation, where them precipitation scale depends how like the homogenity, concentration of metal ions and the amount of dosed of lime that depends on the pH value.The process of neutralization of acidic wastewater is carried out in pH = 7.5-8.5, which in this case comes to heavy metal precipitation.
As a result of the neutralization process and hydrolysis acidic wastewater that comes to precipitation of heavy metals in the form of hydroxide, but as a result of the presence of calcium carbonate comes even to the formation of carbonate. With the introduction of chemical reagent made destabilization of colloids as a result of this we have the process of coagulation. Giving the reagents, which ions react with colloids comes to the elimination of electrostatic forces in colloids.

As a result of the coagulation process and the formation of more floske, to which precipitate. With this reach the precipitation of heavy metals from wastewater, regardless of pH values for some oxides, such as are given in tab.1.following: :

Tab.1.precipitationof pH values of some heavy metal hydroxides are as follows:

Hydroxide	pH value
$Pb(OH)_2$	6
$Zn(OH)_2$	6
$Mg(OH)_2$	11
$AgOH$	9
$Hg(OH)_2$	7-8
$Ca(OH)_2$	7-8
$Cu(OH)_2$	6
$Cd(OH)_2$	7-8
$Zr(OH)_2$	4
$Fe(OH)_3$	2-3
$Ge(OH)_4$	2-3
$Ti(OH)_3$	4
$Ni(OH)_2$	7-8
$Pb(OH)_4$	7-8
$Bi(OH)_3$	6
$Al(OH)_3$	4

Also process wastewater processing is done with the help of flocculant and polyelectrolyte.
FeClSO4 is used as an electrolyte, which serves to create greater floske. Thus the reaction between H2SO and Ca (OH)2 occurs the formation of CaSO4, which is characterized by product solubility lower, which runs the precipitate and detached attracts the heavy metals in the form of hydroxide, as follow reactions:

$$ZnSO4 \ + CaSO4 \ + xH2O \ = \ Zn \ (OH)2 \ + CaSO4 \ + \ yH2O$$
$$CdSO4 \ + CaSO4 \ + xH2O \ = \ Cd \ (OH)2 \ + CaSO4 \ + \ yH2O$$
$$2PbCO3 \ + Pb(OH)2 \ = \ 2 \ Pb \ CO3 \cdot Pb \ (OH)2$$
$$PbSO4 \ + Ca(OH)2 \ + H2O \cdot CO2 = PbCO3 \ + CaSO4 \ + \ H2O$$
$$Pb++ \quad + Ca(OH)2 \ = \ Pb(OH)2$$
$$H2SO4 \ + Ca(OH)2 \ + H2O \ = \ CaSO4 \ + \ H2O$$
$$CuSO4 \ + Ca(OH)2 \ = \ Cu \ (OH)2 \ + CaSO4$$
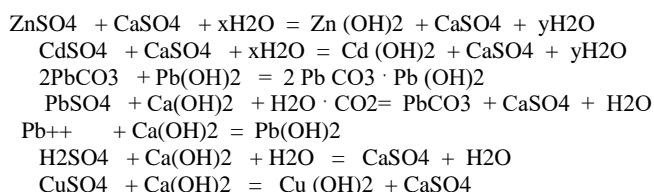
Chemical composition analysis

Verification scale of precipitation of heavy metals and neutralization complete with chalk erased depending on the pH is made independently of content, Pb, Zn, Cu and Cd and that both before and after cleaning the wastewater industrial.

It also has become the research content of heavy metals even in certain pH values of 9 to 10.5 in reservoirs for wastewater neutralization.

Analysis for heavy metals are carried out polarigrafike method and results are given in the table. Wastewater samples were taken every 2 hours and it shaped composite.

Tab. 2. Sample no. 1.

Sample 1 (mg /l)					
Wastewater	pH	Pb	Zn	Cu	Cd
Before cleaning	2.5	3.8	985	1.6	2.7
After cleaning	8	2.3	350	1.1	1.3
After cleaning	9	1.1	130	0.23	0.3
After cleaning	10.5	0.45	11.5	T	T
The eficasity scale of cleaning		88.15	98.83	99.99	99.99

Tab. 3.Sample nr.2.

Sample 2 (mg /l)					
Wastewater	pH	Pb	Zn	Cu	Cd
Para pastrimit Before cleaning	1.9	0.9	904	2.6	1.7
Pas pastrimit After cleaning	8	0.5	305	1.4	1.2
Pas pastrimit After cleaning	9	0.24	110	0.78	0.6
Pas pastrimit After cleaning	10.5	0.12	23.3	0.34	0.15
The eficasity scale of cleaning		86.66	97.42	86.92	91.17

Tab. 4. Sample nr.3.

Mostra 3 (mg /l)					
Wastewater	pH	Pb	Zn	Cu	Cd
Before cleaning	1.5	1.9	1250	1.34	2.7
After cleaning	8	0.4	340	0.7	0.23
After cleaning	9	0.5	85	T	T
After cleaning	10.5	0.03	9.6	T	T
The eficasity scale of cleaning		98.42	99.23	99.99	99.99

Discussion of results

Based   on the   results   obtained reach the conclusion that:
- Precipitation as full of havy metals must be carried out in the pH values of 10.5
-For larger quantities slaked lime added to the pH increase and this increases the degree of purification, the pH of 10.5 to 12.5, because with increasing pH value, zinc passes at zincate.
-At pH values from 10.5 to 12.5 by flow 99.99% efficiency of the impurities removed heavy metals such as Zn, Cu and Cd.
-In the same pH conditions achieved clearance rate of 87% Pb deviation of Pb sçarohet the fact that the optimum pH values for the removal of Pb ranging from 8-10.5. Above these values come back up in the form of $2PbCO_3 Pb (OH)_2$, and with this the increase of the concentration   of   ions present.
-For removing Cu need pH = 8, while the removal of Cd required pH value of about 9. While the limit for Pb reached by difficult.
Limits concentration of heavy metals which may precipitation in the ranges allowed, regardless processing with slaked lime, are quite variable and depend on the nature same pollution.
With the development of the reaction of Pb, Fe and Cu through processing with slaked lime, for a short time come to preceptation in the form of hydroxide, and for Zn and Cd need a longer time.
Research has proven that during the processing of industrial wastewater with slaked lime, precipitation process of heavy metals is effective for the pH value of 10.2.
This applies for Cu, Zn, Fe and Cd, while for Pb to pH values of 10.5, come to his melting with zinc and as a result of the reaction of Pb content exceeded the initial polluted water.
This shows that for determining the degree of purification of industrial wastewater should be in mind keeping the pH value in the ranges allow for an efficient precipitation to each heavy metal.

RESUME

With the process neutralization with slaked lime to achieve that the majority of metal ions preceptiation in the form of hydroxide.
The efficiency of heavy metals preceptiation depending on by pH value with milk lime, as follows: Pb = 65-83%; Zn = 93-99%; Cu = 65-83% and Cd = 95-99%, so it is within the allowed limits and after preparing enabled the issuance of industrial wastewater according to the legal rules for the protection of water.

In cases when have to deal with increased alkaline during the process of neutralization, then we have to add acid melting or an amount of water industrial waste, so that the pH value to correspondence with the conditions of the working environment, as defined according to the rules of law   .

In cases when have the average values of heavy metals in industrial waste water, then needed value is pH = 10.5, while in cases when have with overload process, then needed value is pH= 12.5

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EXTRACTION OF VALUABLE METALS FROM TREPCA LANDFILLED LEAD SMELTING SLAGS WITH WELC PROCESS

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Abstract. The landfilled slags obtained over the years from reduction smelting of lead agglomerates at the Trepca lead smelter contain numerous components as metal oxides and sulphides as well as metals in elementary state. Among others they contain various forms of Pb, Zn, Cu, Ag, Ge, Tl, In, As, Bi, Sb. These are valuable elements that may turn these slags to a new important "raw material" for their extraction.

Based on the chemical composition results of 354 samples and mineralogical analysis then the quantity of these landfilled slag, which is estimated to be about 3 million tons it was concluded that these slags constitute a feasible waste for extraction of valuable metals.

In order to select the optimal process for the separation/extraction of these metals some existing extraction processes were studied based on fuming, electro thermic separation etc. Waelz process was also analysed since it enables the processing of solid slag whose components have different vapour pressures, assures low rate of metal loss during processing and achieves generally good results in terms of economic feasibility.

Introduction

In metallurgy of lead in Trepca complex, slag obtained from the smelting reduction process in the blast furnace and this chemical content : ZnO (8-14%), Pb (0.5-1.8%), Cu (0.15-0.3%), and Ag metals precious values (10 g / t), and this composition oxides: CaO (18-20%), FeO (30-38% SiO2 (20-24%), MgO (2-4), and Al2O3 (4-7%).
The ratio between the slag components is dependent on the amount of ZnO in the slag, so by increasing the amount of ZnO in the slag, increase the amount of FeO, while the reduced amount of SiO2 and CaO.
At slag from the shaft furnace exceed 80% Zn, 20% Cu and 1-1.5, but in cases of disorder was the smelting reduction process, the amount of lead ranges from 3-5%. But in the slag it passes an amount of rare metals such as Ge 65%, 55% Tl, 45% and 30% In.

The following table is given granulometric composition of slag shaft furnace that lead in metallurgy.

Tab.1.Granulometric composition of slage by shaft furnace

mm	0.06	0.04	0.15	0.18	0.20	0.22	0.35	0.42	0.50	0.31	0.67	1.4
%	0.68	0.85	1.3	0.92	1.2	2.4	3.1	3.8	2.7	3.9	4.1	4.8

Experimental Part Chemical Analysis

Determination of chemical analysis of slag through the volumetric method is a support for research opportunities for the application of advanced processes, with the aim of exploitation of metal present in the slag.
Analysis of the chemical composition have been conducted on 354 samples and values obtained were expected and reasonable.Chemical analysis of composition are given in tables, as follows.

Tab.2.Chemical analysis of slage by shaft furnace

Pb %	ZnO %	FeO %	CaO %	SiO_2 %	S %	Cu %
2,35	10,21	39,56	18,31	19,84	0,85	0,22
1,37	11,05	31,28	9,35	24,63	1,27	0,31
1,62	12,15	43,12	20,23	28,51	1,15	0,36
0,57	9,28	38,14	18,62	24,00	0,90	0,18
1,21	9,78	35,23	16,45	21,37	1,35	0,12
0,98	8,68	33,36	16,27	20,18	1,31	0,19
1,00	10,24	37,14	20,71	21,53	2,12	0,21
0,80	7,80	35,00	15,22	21,36	1,65	0,24
1,18	10,14	36,52	17,35	26,75	1,23	0,14
3,12	11,86	40,37	18,06	27,53	1,06	0,27

Mineralogical Analysis

To have a complete overview of material components is done research of mineralogical analyzes of granulated slag from shaft furnaces in Trepca complex, through rengenometric method.
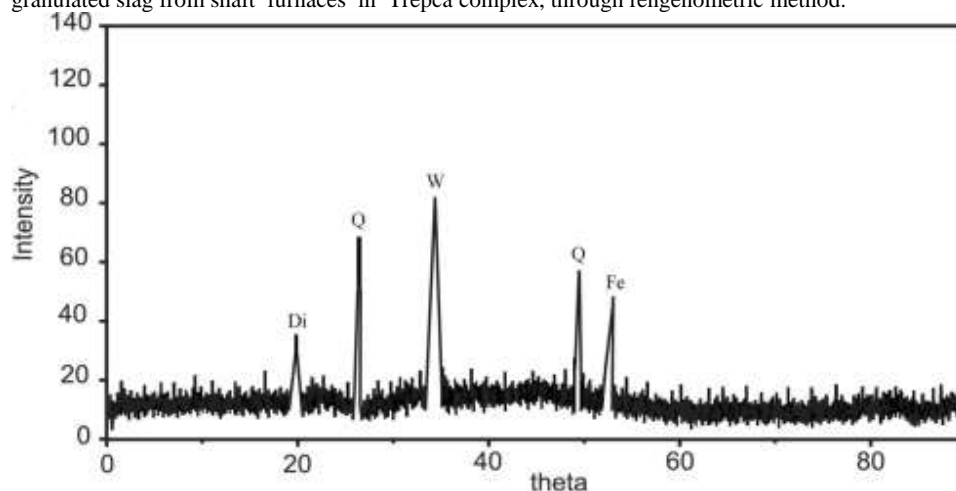
Fig.1.

Where are: Di-Diopsidi $(CaMgSiO_2O_6)$
Q-Geleniti $(Ca_2Al_2SiO_7)$
W-Vistit (FeO)
Fe- Elementari Iron (Fe)
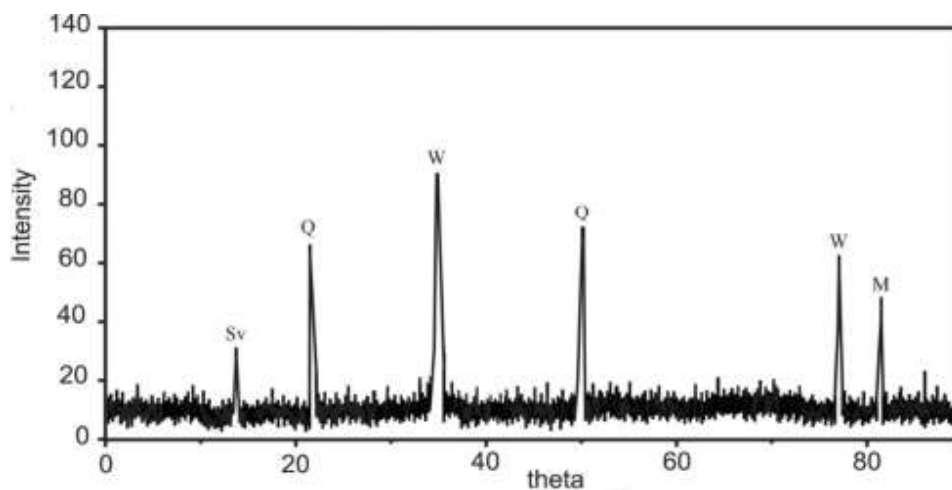
Fig.2

Where are: Sv-Svalerit (ZnS)
Q-Geleniti (Ca₂Al₂SiO₇)
W-Vistit (FeO)
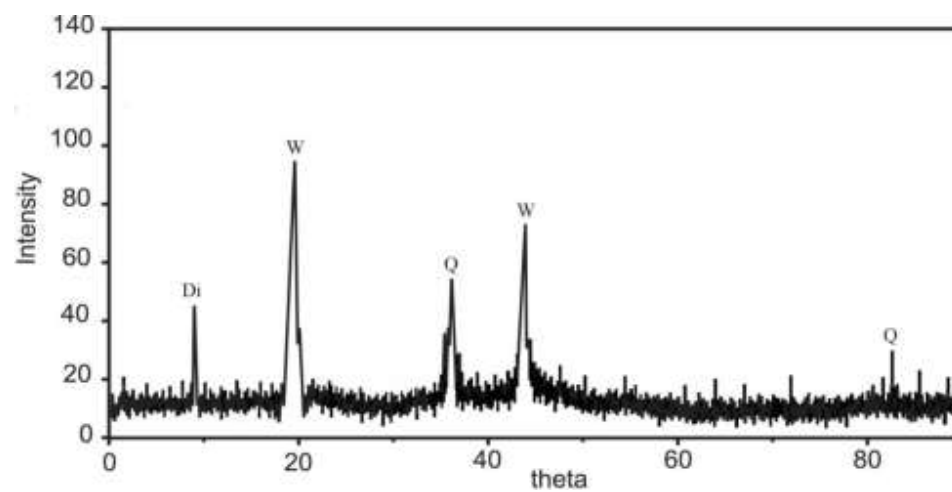
Fig.3

Where are: Di-Diopsidi (CaMgSiO₂O₆)
Q-Geleniti (Ca₂Al₂SiO₇)
W-Vistit (FeO)
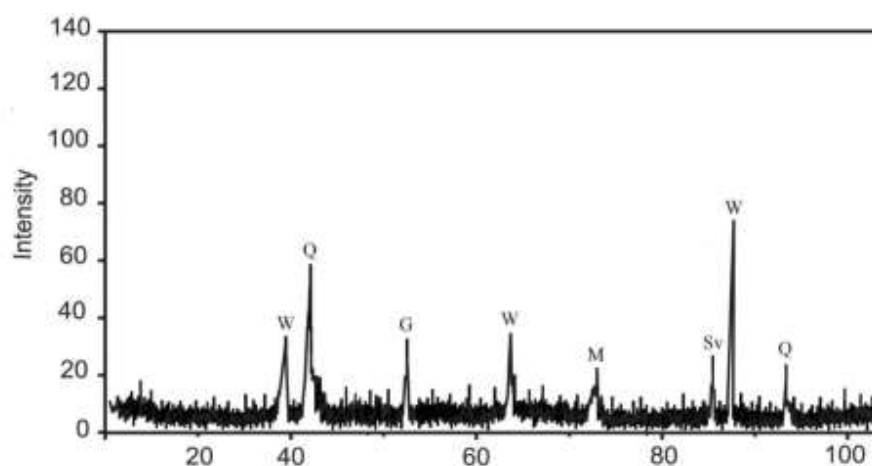
Fig.4.

Where are: M-Magnetit (FeO Fe$_2$O$_3$)
Q-Geleniti (Ca$_2$Al$_2$SiO$_7$)
W-Vistit (FeO)
G-Galeniti (PbS)

Slag   Treatment

Granulated slag treatment shaft furnace that is done through the process of Vellc. The process takes place in oven cylindrical rotation, at an angle of 3-5 °. Sharzha enters at the furnace through head of the furnace, while in the outgoing furnace slag and inserted Sand blast issued. Entering in the composition of slag and dross of lead and coke, which is used as fuel and as reducentm   subject.

After the introduction of slag in the furnace, the furnace starts movement along the horizontal axis and the angle under the influence of furnace sharzha part moving towards its exit, which in this case is done by heating it at a temperature of 1100-1200 ° C, the heat freed of coke combustion and heatof exothermic reactions.

When passing through the furnace becomes reduction of oxides of zinc, lead and cadmium, where the metal vapor in the exhaust gases pass process.

The reactions based on the process are:
 C   + O$_2$ = CO$_2$
 CO$_2$ + C = 2CO
ZnO   + CO = Zn + CO$_2$
PbO   + CO=Pb +CO$_2$
Balanc constant for this reaction is:
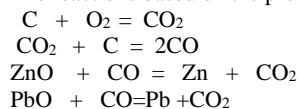
$K = P_A \cdot [PbO]_{Sl}/P_B$

$P_A/P_B = K/\{PbO\}_{Sl}$

P_A, P_B and $[PbO]_{sl}$ are partial pressures of CO, CO_2 and PbO. From the above reactions it can be seen that the reduction of PbO, or any other metal oxide from slag, need higher concentration of CO in the exhaust gases of the process as the lower the concentration of lead oxide in the slag.

And the development reactions:

$ZnO \ SiO_2 + CO = Zn + SiO_2 + CO_2$

$ZnO + CO = Zn + CO_2$

$PbO \ SiO_2 + CO = Pb + SiO_2 + CO_2$

$PbO + CO = Pb + CO_2$
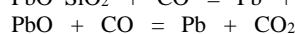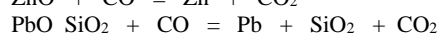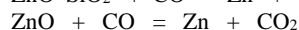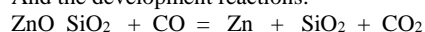
The passing rate of the zinc from the slag in the exhaust gases of the process ranges from 90-93%, while that of Pb ranges from 90-92%, and that of cadmium from 99-99.9%. The composition of the oxide powder is: 60-65% Zn, 11-15% Pb, 0.5-1% Cd, while the composition of the slag (clinker) is: 0.5-0.8% Zn, 0.3-0.5% Pb, 0.5-0.8% Cu, 15-20% C, 200-300g/t   and
        0.5-0.8g/tAu.

Vapor of these metals gained with the process of reduction, in contact with the oxygen of the air which enter the furnace oxidized at proper (due, necessary) oxides , as follows:

$2Zn + O_2 = 2ZnO$

$2PbO + O_2 = 2PbO$
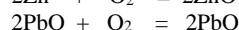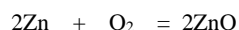
Oxides formed in powder form in the gases pass and then issued us process for cleaning the gas system.

These oxides from the system for cleaning the gas transferred to the metallurgy of zinc, which are subject to processing hidrometalurgjik during which process zinc and other elements pass in the digestion of acid sulfurik and after solution cleaning, zinc undergoes the process of electrolysis, while lead concentrate in the remaining solid and transferred to the production of lead metallurgy.

The remainder of the slag at the end of the process Vellc undergoing processing in copper metallurgy unless contains significant amounts of copper on the contrary can be used in building materials industry.

Discussion of results

From the analysis of the chemical composition clearly seen that the process of smelting slag from shaft furnaces reduction has different chemical composition.

Chemical composition of slag depends of its properties, such as melting temperature, viscosity, specific weight, etc., that has affect at the technical and economical parameters of the process.

Mineralogical analysis on samples from the data shows the presence of components useful and important for Welc process. So we have presence of PbS, PbO and ZnO, which are concentrated in the part of the magnetic fraction of the granulated slag.

-Analysis of the chemical composition are in the ranges of slag and shaft furnace that can be subject to processing   by   Welc   process.

-The contents of Zn is in proportion to the amount of FeO, CaO and SiO.

-Quantity Of Zn in the slag is suitable for processing with Welc process.

-Quantity Of Cu is lower, but the Ag content of 10-15 g/t affects at the profitability of the process.

-So amount of Pb is justifiable for processing with Welc process, especially when taking into account the profitability of the process of Pb in Trepca complex by starting process, a process which is followed by loss of lead in the slag.

-So amount of Pb in slag is high during the disorder was the process used in the blast furnace.

Summary

In metallurgy of lead in recent decades are the current trends for the modernization of the production process.These tendencies are bound by the impoverishment of mineral rich and as well as the need for the use of lead complex concentrates.
Industry development in recent decades has marked a trend of building high, but such a trend is also faced with the lack of raw materials with high quality and inexpensive.

Therefore Welc application process in Trepca Complex will not only resulted in increased production of lead and other metals present, but we will also influenced at Trepca flexibility in terms of the exploitation of the remaining material from the manufacturing process.
Welc process in this way would be reasonable not only in economic terms but also and environmental.

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Fuzzy logic controlofgantry crane system

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Abstract. The use of gantry crane systems for transporting payload is very common in industrial application. However, moving the payload using the crane is not an easy task especially when strict specifications on the swing angle and on the transfer time need to be satisfied. To overcome this problem, an intelligent gantry crane system had been introduced. Fuzzy logic controllers were adopted, designed and implemented for controlling payload position as well as the swing angle of the gantry crane. Fuzzy logic defines rules that determine the behavior of the system using word descriptions instead of mathematical equations also fuzzy logic control algorithms can be used to solve problems that are difficult to address with traditional control techniques. Fuzzy control strategy is proposed to control the stability of crane work.

Keyword: Fuzzy logic controllers, Gantry crane system

1. Introduction

The development of an active suspension system for high performance cranes that aims to reduce the vibrations in the base of the crane's frame. The oscillations are caused mainly by disturbances that come from the contact between the rollers parts of the suspensions with the alignment guides fixed to the building structure during the crane movement. These guides, although modern processes of manufacture and installation, present inherently small misaligns that are caused normally by disturbances in the installation processes. The movements caused for the semis alignments, mainly for the high speed cranes of high building (skyscrapers), can compromise the requirements of security and comfort. Consequently, high technology companies are spending resources in the development of modern systems, as active control, to improve the performance of the crane's suspensions without increasing its size and weight, as occurs with the traditional passive systems.
This situation can be proven by the elevated number of patents since the middle of the last decade. In this work it is aimed to reduce the vibration of the crane using fuzzy logic algorithm in order to make an accurate masses translation. [1]

2. Mathematical modeling of gantry crane

A schematic diagram of a gantry crane model is shown in Fig 1.Generally the configuration of this model is specified by the horizontal position of trolley x, the length of the hoisting cable l, and the sway angle theta θ. [2]A number of assumptions are made in order to simplify the system:
· The trolley and the payload move or oscillate in x plane.
· The tension force that will cause the hoisting cable to elongate is neglected.
· Both the trolley and the payload are considered as point masses.
· The friction between the trolley and the rail is neglected.
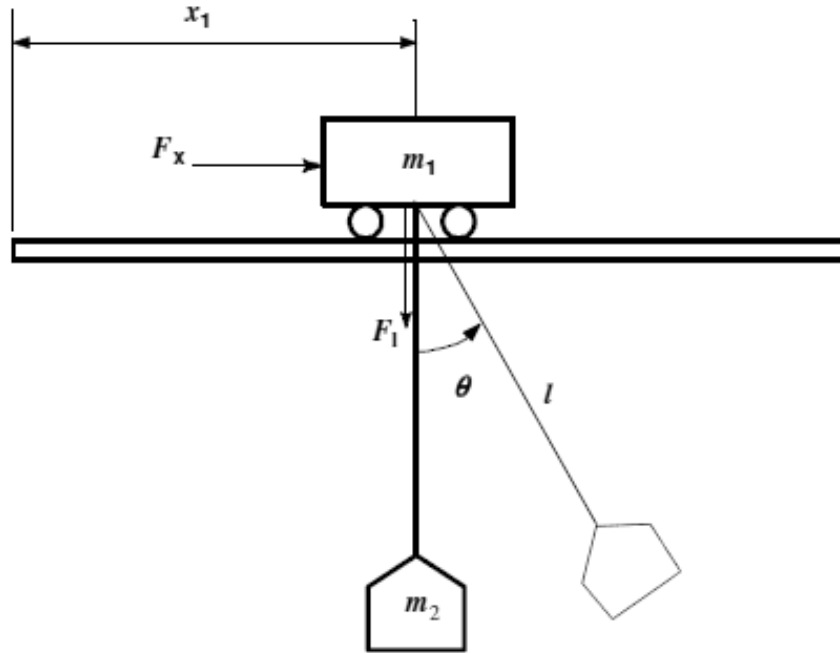
Fig. 1. Schematic diagram of a gantry crane model

The equations of motion for a linearized model of a gantry crane are represented as follows:

$$F_x = (m_1 + m_2)\ddot{x} + m_2 l \ddot{\theta} \qquad (1)$$

$$l\ddot{\theta} + \ddot{x} + g\theta = 0 \qquad (2)$$

$$F_t = m_2 \ddot{x}\theta - m_2 g \qquad (3)$$

3. Dynamic model of gantry crane

The mathematical model of the gantry crane was developed and its parameters are identified. The developed gantry crane model is used to design controller, and to make simulation. The developed model of the crane is:

$$\frac{X_{(S)}}{U_{(S)}} = \frac{1.28}{s(0.002689s^2 + 0.2529s + 1.314)} \tag{4}$$

$$\frac{\theta_{(S)}}{X_{(S)}} = \frac{-s^2}{3s^2 + 9.81} \tag{5}$$

where U(s), X(s) and θ(s) are input power, trolley displacement and load swing angle respectively.

4. Proposed controller

The structure of the proposed controller for the gantry crane system is shown in Figure 2. The proposed controller consists of fuzzy logic controllers for both position and anti-swing control respectively. The objective of the proposed fuzzy logic controllers is to control the payload position X(s) so that it moves to the desired position Xref(s) as fast as possible without excessive swing angle of the payload θ(s). [3]
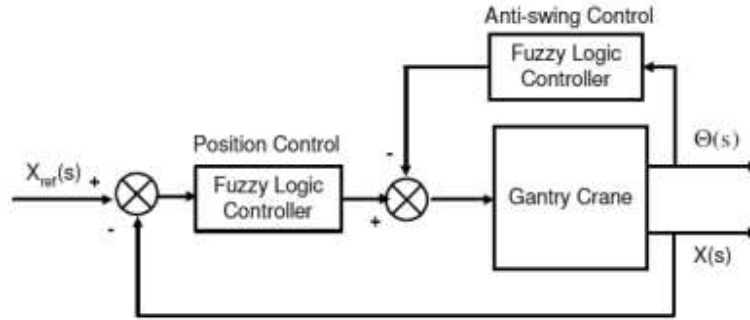
Fig. 2. Proposed fuzzy-based intelligent gantry crane system

For our system we have this structure of the model in Simulink:
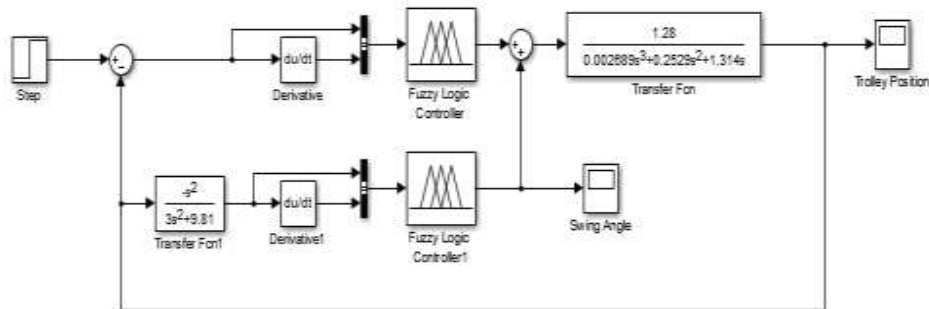
Fig. 3. Simulink diagram of the proposed system

5. Design of Fuzzy Logic Controller

The main design process of the fuzzy logic controller consists of the development of input and output of the membership functions, fuzzy rule base and defuzzification method. In the position control, error and error rate of position are taken into consideration as inputs. On the other hand, swing angle and swing angle rate are used as inputs for anti-swing control. Meanwhile, the voltage is taken as an output. [3]
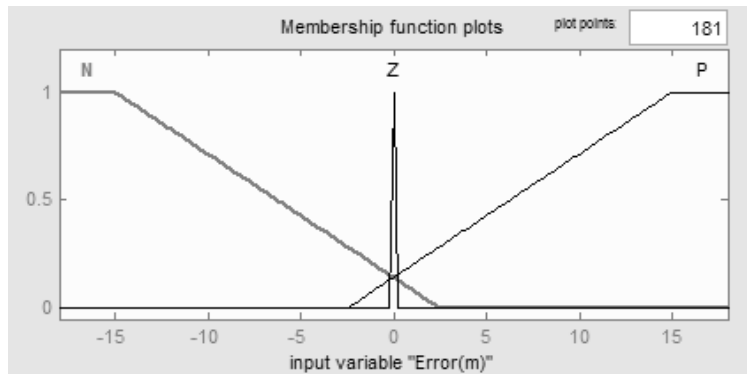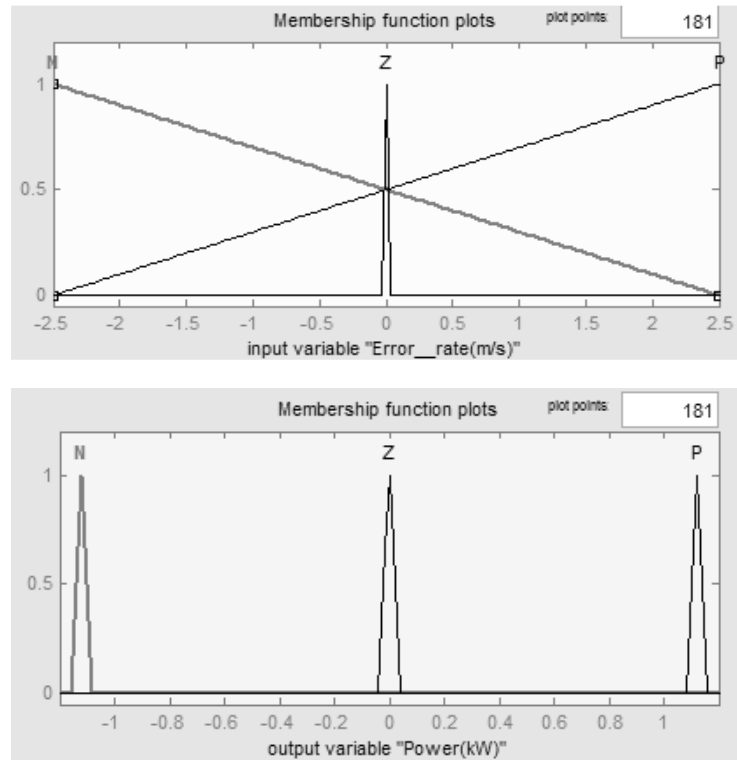
Fig. 4. Membership function for Trolley Position
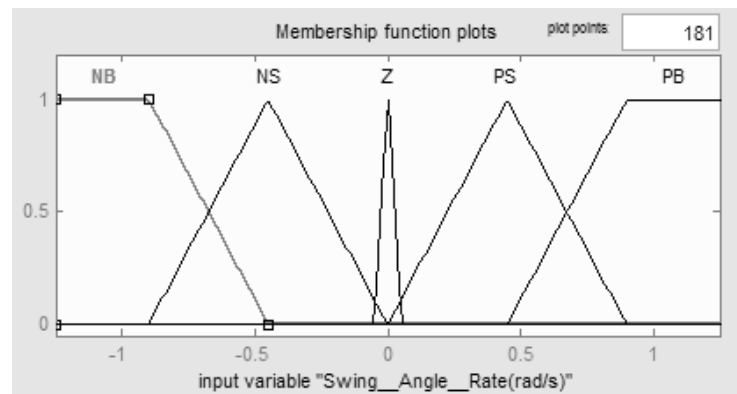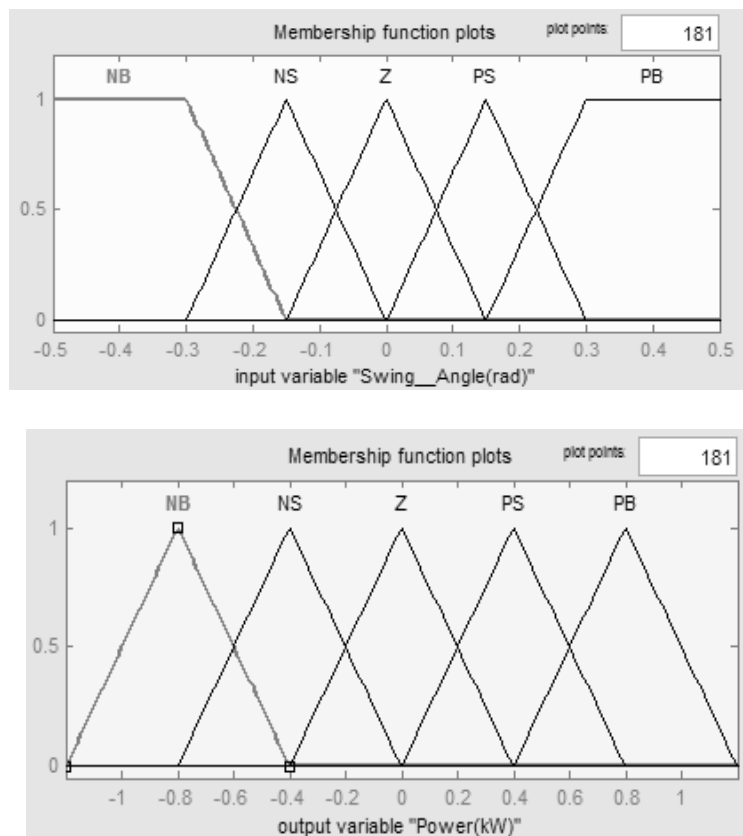
Fig. 5. Membership function for Swing Angle

The rules of fuzzy position and fuzzy anti-swing controls are adopted from experiences. Therefore, error and error rate are used in order to generate the rules. Tables 1 and 2 list the generated linguistic rules for position and anti-swing control respectively.

Error Rate Error		Error rate		
		P	Z	N
Error	P	P	P	P
	Z	N	Z	P
	N	N	N	N

Tab.1. Fuzzy rule base of position control
Tab.2. Fuzzy rule base of anti-swing control

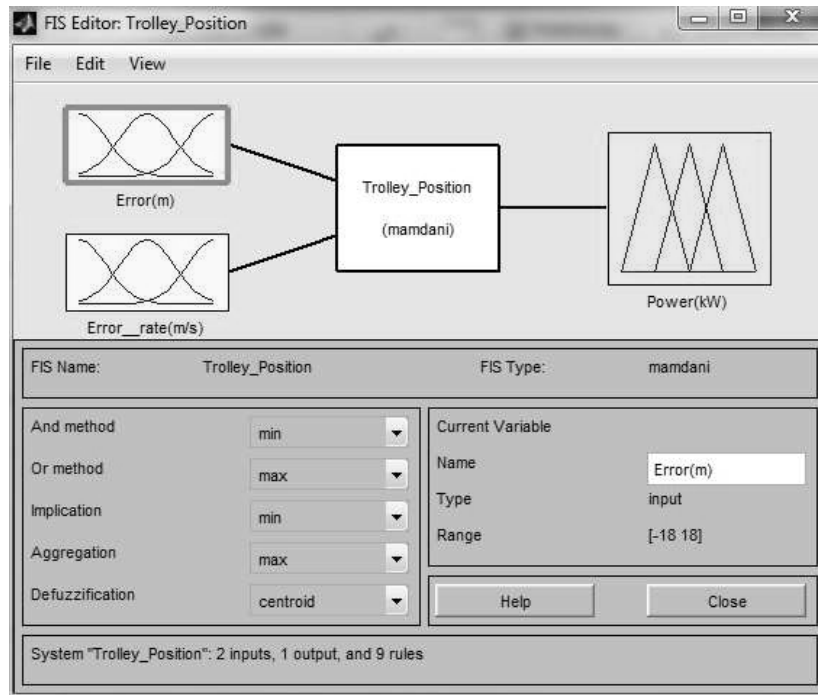As we show, we have two fuzzy logic controllers, one for trolley position and one for swing angle:
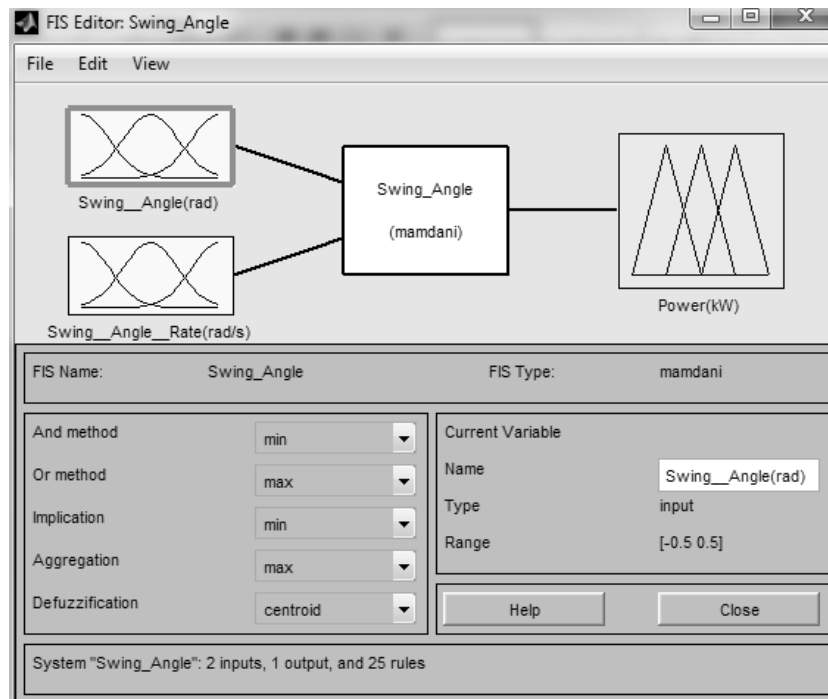

Fig. 6. FIS Editor for Trolley Position

Fig. 7. FIS Editor for Swing angle

Results

So while we do not have a system of crane which is tested in lab or in practice, as such topic is examined in a system of crane parameters assumed by experience but also by calculation which they are based on the power of the motor. In our case, the motor has the power of 3.7kW which is sufficient for moving the crane with these maximal parameters:

- Mass of trolley = 5kN
- Mass of payload = 30kN
- Cable length = 3m
- Distance = 18m

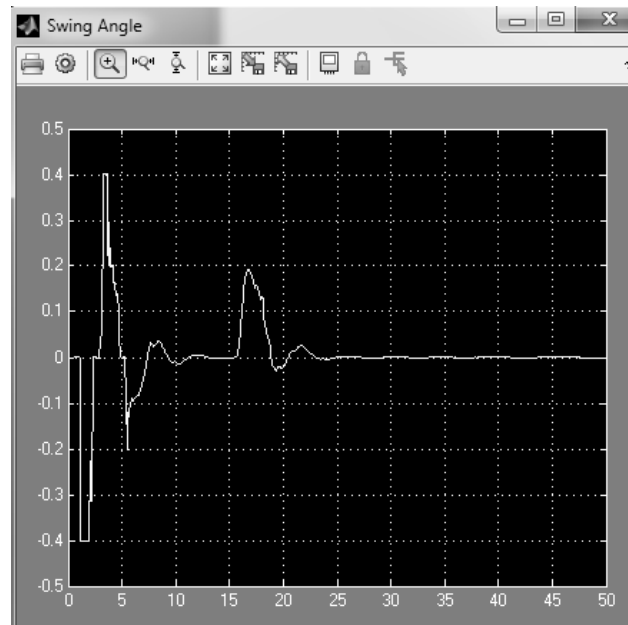Based on the simulation in Matlab software we have gained these results for this case:
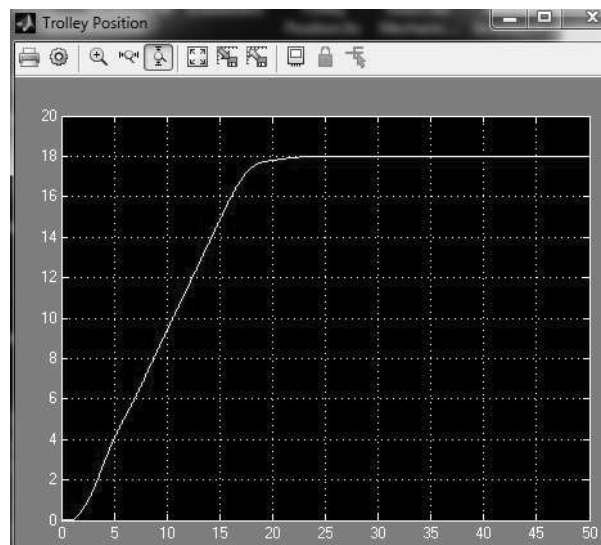
Fig. 7. Diagram time(s) / position (m)

Fig.8. Diagram time(s) / swing angle (rad)

Different results of simulation

- Distance: 2m
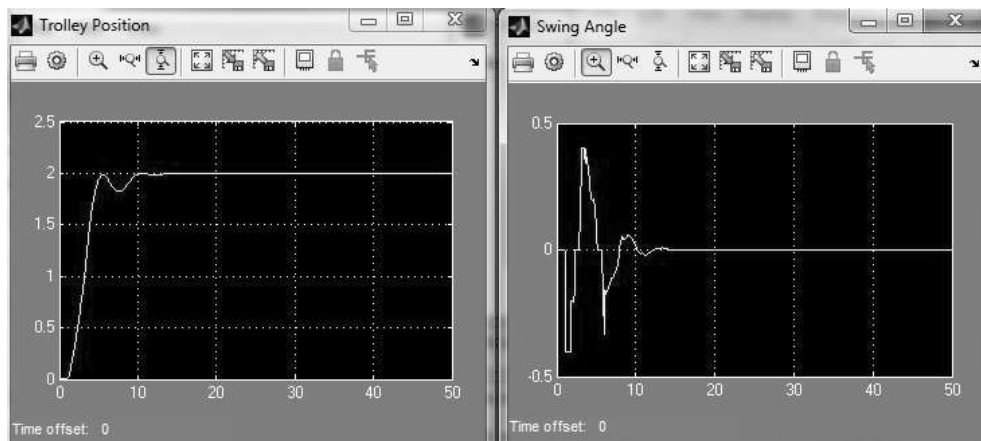
- Cable length: 3m

Fig. 9. Diagram time (s) / trolley position (m) and swing angle (rad)
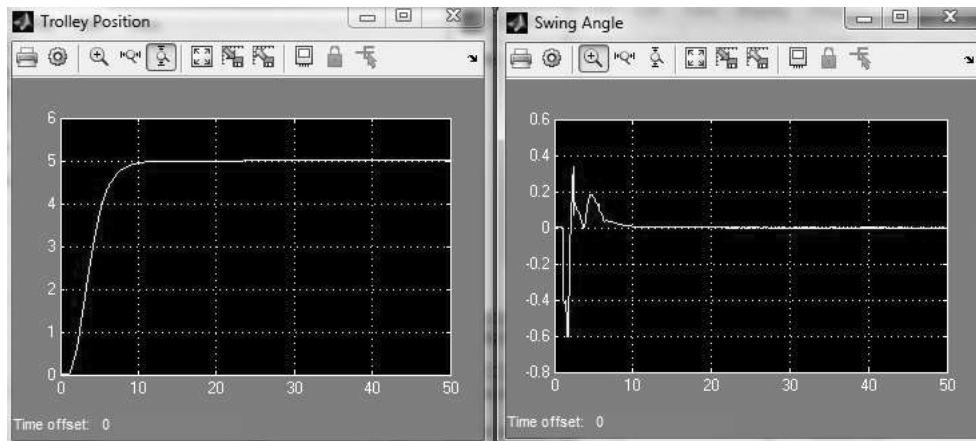
-Distance: 5m

-Cable length: 1m

Fig. 10. Diagram time (s) / trolley position (m) and swing angle (rad)

Conclusion

Fuzzy logic controllers were adopted and designed for realizing the intelligent gantry crane system. The result shows that the intelligent gantry crane system has a performance and more robust to parameter variation. By using the developed model, the dynamic behavior of the controller has been evaluated using Matlab and Simulink. The performances of the controller are examined in terms of vibration reduction of sway angle and a stable positioning.

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Why Modeling Complex Dynamic Systems using Fuzzy Cognitive Maps?

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Abstract. The difficult problem of modeling Complex Dynamic Systems (CDS) is carefully reviewed. Main characteristics of CDS are considered and analyzed. Today's mathematical models and approaches cannot provide satisfactory answers to the challenging problems of the society. The key problem of complex dynamic systems and control theory consists in the development of methods of qualitative analysis of the dynamics and behavior of such systems and in the construction of efficient control algorithms for their efficient operation. The purpose of control to bring the system to a point of its phase space which corresponds to maximal or minimal value of the chosen efficiency criterion is reviewed and analyzed. The reasons for using Fuzzy Cognitive Maps (FCMs) in modeling Complex dynamic Systems are provided. The basics of FCMs are briefly presented. An illustrative example is considered and interesting results are presented and discussed.

Keywords: Modelling, Complex dynamic systems, Fuzzy logic, Intelligent Systems, Fuzzy Cognitive Maps

1. Introduction

Today one scientific practice that all of us must be doing constantly is to listen to others and raise serious and challenging questions. Here are some. What is a Complex Dynamic System (CDS)? What are its main characteristics? What are the best models for studying them? Do all models have detailed software tools that can adequately simulate their behavior? Do we have a clear and sound scientific understanding of the concepts of chaos, complexity and uncertainty? And how these three concepts are taken into consideration when studying, modeling, analyzing and designing a CDS?? How theories of Large Scale Systems (LSS) as well as for Multilevel Hierarchical have taken into consideration the concepts of chaos, complexity and uncertainty? We can continue raising one question after the other and then try to understand the provided solutions and then raising more questions. Do all these models and associated solutions provide satisfactory and working conditions to the everyday behavior of the complex dynamic systems? We can say that for a good number of real cases the provided models and solutions meet the objectives and goals of the complex dynamic system. However there are also a good and large number of situations where today's models and solutions fail to give satisfactory answers to a number of problems associated with them.

Can we search and identify the sources for this failure? May be! I believe that the main reasons are our inability to comprehend and understand well and precisely the actual dynamic and chaotic behavior of complex dynamic systems in the presence of uncertainty, fuzziness and structural complexity. This is also due to the fact all these concepts have different interpretations and mathematical explanations by different people. Another important factor here is the solid knowledge and experience of the scientists been involved in the process and on making decisions subsequently. Some scientist combine all above factors into one term: UNCERTAINTY and try to explain everything using theories ant techniques that have been developed to model, understand, analyze and finally arrive in taking decisions. However all these efforts have still failed to provide satisfactory answers to the real problems faced by the behavior of complex dynamic systems?

2. Challenging Issues in Modeling and Controlling Complex Dynamic Systems

Modeling is a fundamental work which is always the starting point for control, optimisation, and implementation of complex dynamic systems (CDS). Complex dynamic systems present problems both in mathematical modelling and philosophical foundations. CDS comprise of collections of many heterogeneous entities which interact with other entities and their environment which usually are having a lot of uncertainties and structural complexities. Interactions among subsystems are localized, often seeking autonomy and self-organizing, while most of the times are nonlinear, dynamic, fuzzy and possibly chaotic. The study of CDS represents a new approach to science that investigates how relationships between parts give rise to the collective behaviors of a system and how the system interacts and forms relationships with its environment. CDS have some specific characteristics, among which are: uniqueness, weak structuredness of knowledge about the system, incompleteness of its dynamic behavior, antagonism among different agents, the composite nature of system, heterogeneity of elements composing the system. Furthermore decisions must be made ensuring the smooth, reliable, stable and cost effective operation of each of the subsystem as well the whole CDS [11],[12],[13]. Thus modeling CDSs is indeed a real chalenge. It is not so a straightforward and an easy task. Indeed it is a difficult exercise and cannot be completed by using today's formal methods.

Another important feature of CDS is that a network structure, including hierarchical one, self-organization can amount to: (1) disconnecting certain constituent nodes from the system, (2) connecting previously disconnected nodes to the same or to other nodes, (3) acquiring new nodes, (4) discarding existing nodes, (5) acquiring new links, (6) discarding existing links, (7) removing or modifying existing links. In addition CDS should have a number of properties-abilities such as; co-evolution, anticipation, adaptation, emergence, self-evaluation, Robustness and wisdom [1], [2], [5].

Finally **collective dynamics of a CDS give rise to 'Emergent Evolution Properties' (EEP) at higher scales in space and/or time among some which are:** cooperation such as swarming, intelligence, consciousness, genetic regulation – homeostasis, development, disease, cascading failures in electrical grid, invasiveness in plants, hurricanes and self-repairing materials. Under such conditions, the key problem of complex dynamic systems and control theory consists in the development of methods of qualitative analysis of the dynamics and behavior of such systems and in the construction of efficient control algorithms for their efficient operation. In a general case, the purpose of control is to bring the system to a point of its phase space which corresponds to maximal or minimal value of the chosen efficiency criterion. Another one of the main and actual problems in the theory of complex dynamical systems and control sciences is a solution of "ill-posed, weakly- and

poorly-structured and weakly- formalizable complex problems" associated with complex technical, organizational, social, economic, cognitive and many other objects, and with the perspectives of their evolution.Therefore the modeling and analysis of complex dynamic systems in the presence of principally non- formalizable problems and not probable of having strict mathematical formulation of the system, on environments that decisions are semi- structured or unstructured, knowledge-base systems (KBS) needs to be readdressed. All above characteristics must be taken into consideration. Construction of models of CDS must be based on the use of experts and their extensive knowledge about the system. This knowledge should be wisely used. However qualitative description of most of the parameters of complex dynamic systems results inevitably in fuzziness, complexity and uncertainty. All these unfortunately complicate the problem of formal modeling the CDS and it supports the fact that complex dynamical systems are usually difficult to model, analyze, design, and optimally controlled [3],[4],[6],[7]. Thus the need for seeking new advanced conceptual modeling methods.

For all the above reasons the approach in modeling Complex Dynamic Systems using Fuzzy Cognitive Maps seem a promising as will be demonstrated in the next two sections.

3. Basics of Fuzzy Cognitive Maps (FCM)

Fuzzy Cognitive Maps (FCMs) is a new methodology for modeling complex dynamic systems and has been around only for the last 25-30 years. FCMs basically exploit the knowledge and experience of "people". Fuzzy Cognitive Maps came as a combination of the methods of fuzzy logic and neural networks. They constitute a computational method that is able to examine situations during which the human thinking process involves fuzzy or uncertain descriptions. Fuzzy Cognitive Maps were introduced by Kosko in 1988 [19] and they are a soft computing methodology that which gives users the ability to encounter problems in the same way the human mind does; using a conceptual procedure which can include ambiguous or fuzzy descriptions. They therefore offer an economical, flexible, fast and versatile approach to a variety of problems (social , political, economic , environmental and mechanical) which are extremely complex and a purely mathematical approach would be time consuming, laborious and require wasting many resources. Kosko introduced FCMs as a method to represent the causal relationship between concepts- nodes. Their goal is to represent knowledge in a symbolic way and model the behavior of systems containing elements with complex relationships, which sometimes can be hidden or illegible.

An FCM presents a graphical representation used to describe the cause and effect relations between nodes, thus giving us the opportunity to describe the behavior of a system in a simple and symbolic way. In order to ensure the operation of the system, FCMs embody the accumulated knowledge and experience from experts who know how the system behaves in different circumstances. In other words they recommend a modeling process consisting of an array of interconnected and interdependent nodes C_i (variables), as well as the relationships between them W (weights).Concepts take values in the interval [0,1] and weights belong in the interval [-1,1]. A more comprehensive mathematical presentation of FCMs is provided in [14],[15],[16],[17],[18].

4. An Illustrative Example When Using Fuzzy Cognitive Maps (FCM)

With a simple example of Decision Making for the Stability of an Enterprise [8],[9],[10] in a Crisis Period using FCMs we can show that the new approach of FCMs in modelling CDS is very promising. In the current FCM model there is only one decision concept (output), i.e. the stability of an enterprise in a crisis period is studied: concept_8. The factor concepts are considered as measurements (via special statistic research) that determine how each measurement-concept will function in this model and they are: C1: sales, C2: turnover, C3: expenditures, C4: debts & loans, C5: research & innovation, C6: investments, C7: market share, C9: present capital, while C8: stability of enterprise is the output of the system.

Figure 1 shows a simple FCM model for the enterprise system. At this point it should be noted that in economic systems we can't talk about causality but only for correlation between the defined factor-concepts of this problem. Experts noted that the acceptable-desired region for the final value of concept C8 is:

$$0.70 \leq C_8^{(final)} \leq 0.95$$

If C8(final) is inside this region then we can say with great certainty that the enterprise is out of danger and the economic crisis period does not put at risk the stability and the smooth function of the enterprise. Weights in table 1 are determined after defuzzifying (with COA method) the fuzzy values that were given from the experts (mostly economists).

Table 1. Weights between concepts for Enterprise System.

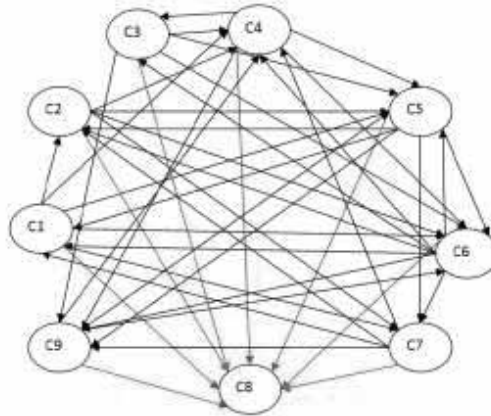|	C1	C2	C3	C4	C5	C6	C7	C8	C9
C1	0	0.6	0	-0.4	0.2	0.3	0.6	0.8	0
C2	0	0	0	-0.2	0.2	0.5	0.1	0.3	0
C3	0	0	0	0.4	-0.5	-0.4	0	-0.6	-0.5
C4	0	0	-0.4	0	-0.7	-0.8	0	-0.7	-0.4
C5	0.2	0.3	0	0	0	0.5	0.3	0.2	-0.2
C6	0.3	0.2	0.6	0.5	-0.3	0	0.3	0.3	-0.4
C7	0.4	0.3	0	-0.2	0	0	0	0.4	0.5
C8	0	0	0	0	0	0	0	0	0
C9	0	0	0	-0.3	0.2	0.4	0	0.2	0

Fig. 1. A conceptual FCM model for Stability of the Enterprise.

In addition, the degree of occurrence of each input-concept factor is denoted with qualitative degrees of high, medium, and low. Respectively for the output concept C8 the qualitative degrees are very low, low, medium, high and very high.

Table 2. Initial factor-concepts fuzzy value.

Factor-concepts	Case 1
C1	H
C2	M
C3	L
C4	L
C5	M
C6	L
C7	L
C9	M

The initial values of the outputs were set equal to zero. The iterative procedure is being terminated when the values of Ci concepts has no difference between the latest three iterations. Considering $\lambda=1$ for the unipolar sigmoid function and after 11 iteration steps the FCM reaches an equilibrium point.
We considered initial values for the concepts: $A^{(0)}$=[0.8867 0.4667 0.0967 0.0967 0.4667 0.0967 0.0967 0.65 0.4667]
It is observed that in the latest three iterations there is no difference between the values of concepts Ci. So after 11 iteration steps, the FCM reaches an equilibrium point where the values do not change any more from their previous ones, that is:
$A^{(11)}$=[0.8140 0.8708 0.7145 0.6121 0.4743 0.7462 0.8581 **0.8391** 0.4779]
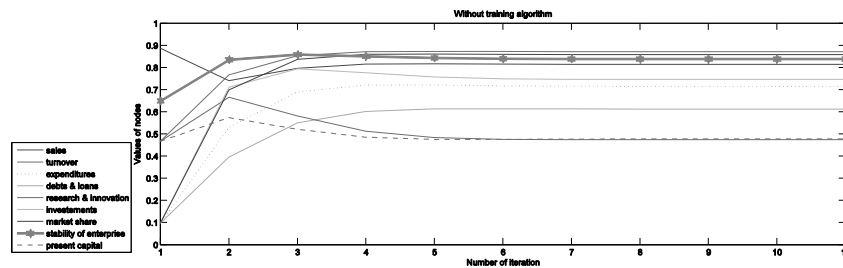Decision concept C8 (Stability of the Enterprise) is equal to 0.8391.

Fig. 2. Subsequent values of concepts till convergence.

Since the final value of C8(final) is inside the acceptable region, defined by the experts, then we could assume with great certainty that the enterprise can survive the crisis period.

Conclusions and Future Research

In this paper one of the most difficult and challenging problem in modelling, analyzing and controlling complex dynamic systems (CDS) has been seriously addressed. The analysis and efficient control of CDS are impossible without a formal model of the system. However today's' technologies for building such models for CDS are not sufficient. Qualitative description of most of the parameters of complex dynamic systems results inevitably in fuzziness, complexity and uncertainty. One of the challenges of accepting the "operation" of any complex dynamic system is the ability to make Decisions so the system runs efficiently and cost effectively. New conceptual and innovative approaches are needed. It is absolutely necessary to accept that Knowledge is the one and only one that can lead us in developing such models. And this knowledge must come from more than one expert who has extensive experience in observing and working on today's CDS. Decisions must be made by new Decision Making Support Systems (DMSS) which utilize new advanced and intelligent systems. Such a new approach is proposed to be Fuzzy Cognitive Maps (FCMs). FCMs offer the opportunity to produce better knowledge based on systems applications, addressing the need to handle uncertainties, fuzziness and inaccuracies associated with real CDS's problems. The illustrative example been provided in this plenary paper and the obtained results are promising for future research efforts in this exciting field of research.
Challenging future research directions include: new models of FCMs for CDS using learning methods; develop new DMSS using intelligent systems and advanced neural network theories; develop mathematical models using new advance FCMs for different applications and using a number of experts; develop new software tools for various CDS and perform extensive simulations.

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