2013

Industrial, Systems and Design Engineering Abstracts

First Annual International Conference on Industrial, Systems and Design Engineering

24-27 June 2013, Athens, Greece

Edited by Gregory T. Papanikos

THE ATHENS INSTITUTE FOR EDUCATION AND RESEARCH

1st Annual International Conference on Industrial, Systems and Design Engineering

24-27 June 2013, Athens, Greece

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(In Alphabetical Order by Author's Family name)

Preface

This abstract book includes all the abstracts of the papers presented at the 1st Industrial, Systems and Design Engineering, *24-27 June 2013,* organized by the Athens Institute for Education and Research. In total there were 20 papers and 32 presenters, coming from 14 different countries (Brazil, Bulgaria, Canada, China, Germany, Mexico, Poland, South Africa, South Korea, Switzerland, Taiwan, Turkey, UK, USA). The conference was organized into VIII sessions that included areas of Technology and Innovation, Supply Chain Management, Forecasting, Data Mining and Pattern Detection, Design & Manufacturing and other related fields. As it is the publication policy of the Institute, the papers presented in this conference will be considered for publication in one of the books of ATINER.

The Institute was established in 1995 as an independent academic organization with the mission to become a forum where academics and researchers from all over the world could meet in Athens and exchange ideas on their research and consider the future developments of their fields of study. Our mission is to make ATHENS a place where academics and researchers from all over the world meet to discuss the developments of their discipline and present their work. To serve this purpose, conferences are organized along the lines of well established and well defined scientific disciplines. In addition, interdisciplinary conferences are also organized because they serve the mission statement of the Institute. Since 1995, ATINER has organized more than 150 international conferences and has published over 100 books. Academically, the Institute is organized into four research divisions and nineteen research units. Each research unit organizes at least one annual conference and undertakes various small and large research projects.

I would like to thank all the participants, the members of the organizing and academic committee and most importantly the administration staff of ATINER for putting this conference together.

Gregory T. Papanikos
President

FINAL CONFERENCE PROGRAM
1st Annual International Conference on Industrial, Systems and Design Engineering, 24-27 May 2013, Athens, Greece
PROGRAM

Conference Venue: Titania Hotel (52 Panepistimiou Avenue)

ORGANIZING AND SCIENTIFIC COMMITTEE

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11. Ms. Lila Skountridaki, Researcher, ATINER & Ph.D. Student, University of Strathclyde, U.K.
12. Mr. Vasilis Charalampopoulos, Researcher, ATINER & Ph.D. Student, University of Stirling, U.K.

Administration

Fani Balaska, Stavroula Kiritsi, Eirini Lentzou, Konstantinos Manolidis, Katerina Maraki & Celia Sakka

CONFERENCE PROGRAM

(The time for each session includes at least 10 minutes coffee break)

Monday 24 June 2013

08:30-09:00 Registration

09:00-09:15 Welcome and Opening Remarks

1. Dr. Gregory T. Papanikos, President, ATINER.
2. Dr. George Poulos, Vice-President of Research, ATINER & Emeritus Professor, University of South Africa, South Africa.
3. Dr. Panagiotis Petratos, Vice-President of ICT, ATINER & Associate Professor of Computer Information Systems, California State University, Stanislaus, USA.
4. Dr. Theodore Trafalis, Academic Member, ATINER & Professor of Industrial and Systems Engineering, The University of Oklahoma, USA.

09:15-11:00 Session I: Technology and Innovation

Chair: Panagiotis Petratos, Vice-President of ICT, ATINER & Associate Professor of Computer Information Systems, California State University, Stanislaus, USA.

1. Louis Freund, Professor, San Jose State University, USA. Introducing Service Systems Engineering into the ISE Curriculum.
2. Shing Chih Tsai, Associate Professor, National Cheng Kung University, Taiwan & Ya-Xin Zheng, Professor, National Cheng Kung University, Taiwan. A Simulation Optimization Approach for a Multi-Echelon Inventory System with Service Level Constraints. (Monday 24 June 2013)
3. Jerzy Grobelny, Professor, Wroclaw University of Technology, Poland & Rafal Michalski, Assistant Professor, Wroclaw University of Technology, Poland. The Use of Scatter Plots for Finding Initial Solutions for Selected Facility Layout Problem Algorithms.

11:00-12:30 Session II: Supply Chain Management

Chair: George Poulos, Vice-President of Research, ATINER & Emeritus Professor, University of South Africa, South Africa.

1. Mauro Sampaio, Professor, FEI University, Brazil. Buyer-Supplier Relationship: The Impact of Service Logistics Level in Customer Satisfaction and Loyalty.
2. *Ping Ji, Associate Professor, The Hong Kong Polytechnic University, P. R. China & Xin Ma, Student, The Hong Kong Polytechnic University, P. R. China. Ranking Green Suppliers by Evolutionary Game Theory.
3. Rodolfo Ramirez, Full-time Master Student, University of Sonora, Mexico & Guillermo Cuamea-Cruz, Full-time professor, University of Sonora, Mexico. Real-time Production Visibility Protocol using Radiofrequency Identification Technology at a Blinds Manufacturing Company.

12:30-13:30 Lunch (details during registration)

13:30-15:00 Session III: Forecasting, Data Mining and Pattern Detection
Chair: *Ping Ji, Associate Professor, The Hong Kong Polytechnic University, P. R. China

1. Elisaveta Kirilova, Assistant Professor, Bulgarian Academy of Sciences, Bulgaria, Sophia Yankova, Assistant Professor, Bulgarian Academy of Sciences, Bulgaria, Bilyana Ilieva, Ph.D. Student, Bulgarian Academy of Sciences, Bulgaria & Natasha Vaklieva-Bancheva, Professor, Bulgarian Academy of Sciences, Bulgaria. Modelling of Bioconversion of Crude Glycerol from Biodiesel Production by Using Dynamic Artificial Neural Network. (Monday 24th of June 2013)
2. Vera Lucia Milani Martins, Ph.D. Student, Federal University of Rio Grande do Sul, Brazil & Liane Werner, Professor, Federal University of Rio Grande do Sul, Brazil. Combination of Forecasts: A Comparative Study Applied to Industrial Series.

15:00-16:30 Session IV: Open Session I
Chair: Nicholas Pappas, Vice-President of Academics, ATINER & Professor, Sam Houston University, USA.

1. Sean Gallagher, Associate Professor, Auburn University, USA. Fatigue Failure Theory May Explain Observed Force X Repetition Interaction For Musculoskeletal Disorder Risk.
2. Toli Xanthopoulos, Professor, Benedictine University, USA. Reliability Analysis for Financial Compliance Analysis.

21:00–23:00 Greek Night (Details during registration)

Tuesday 25 June 2013

09:00-11:00 Session VI: Design & Manufacturing
Chair: Vasiliki Kostami, Professor, London Business School, UK

1. *Rama Bhat, Professor, Concordia University, Canada, Chandra Asthana, Associate Professor, Concordia University, Canada & Ajinkya Gharapurkar, Professor, Concordia University, Canada. Optimally Adaptive Oleo Strut Damping for UAV Using MR Fluid.
2. Max Edelmann, Scientific Assistant, Institute of Automation, University of Applied Sciences, Switzerland & Roland Anderegg, Head of Institute, Professor of Mechatronics, University of Applied Sciences, Switzerland. Non-Linear Control of Robot Aided Belt Grinding Manufacturing Process.
3. Jan Erik Heller, Ph.D. Student, RWTH Aachen University, Germany & Jorg Feldhusen, Director of the Institute, Institute for Engineering Design, RWTH Aachen University, Germany. Enhanced Function Structure Applicability through Adaptive Function Templates.
4. Akif Bulgak, Professor, Concordia University, Canada. Dynamic Cellular Manufacturing Design with Human Resource Issues.

11:00-12:30 Session VII: Industrial Organization and Business Models
Chair: *Rama Bhat, Professor, Concordia University, Canada

1. Vasiliki Kostami, Professor, London Business School, UK & Sampath Rajagopalan, Professor, Marshall School of Business, USC, USA. Speed Quality Trade-offs in a Dynamic Model.
2. Agnieszka Kowalska-Styczen, Assistant Professor, The Silesian University of Technology, Poland. The Impact of a Word of Mouth Mechanism on an Adoption of Changes in the Industrial Organization.
3. Sami Ercan, Professor, Istanbul Arel University, Turkey & Volkan Cakir, Assistant Professor, Istanbul Arel University, Turkey. Decision Making in Learning Organizations.

12:30-13:30 Lunch (Details during registration)

13:30-15:30 Session VIII: Industrial and Systems Engineering Education & Engineering Applications
Chair: Theodore Trafalis, Academic Member, ATINER & Professor of Industrial and Systems Engineering, The University of Oklahoma, USA.

1. Peter Bohm, Professor, University of Applied Sciences Trier, Germany. Damage Analysis on a Broken Crank Shaft of a High Power Pump.
2. *Laura Stanley, Assistant Professor, Montana State University, USA. Complexity of Instrumentation in Assessing Virtual vs Real World Hazard Perception Environments.
3. Ho-Yeon Kim, Principal Researcher, R&D Division, Korea Gas Corporation, South Korea, Cha-Hwan Kim, R&D Division, Korea Gas Corporation, South Korea, Min-Su Seo, R&D Division, Korea Gas Corporation, South Korea , Dong-Guen Han, R&D Division, Korea Gas Corporation, South Korea, Kyeong-Il Chai, Mechanical Engineering of Chung-Buk National University, South Korea, Yoon-Hwan Kim, Mechanical Engineering of Chung-Buk National University, South Korea, Seok-Ho Rhi, Mechanical Engineering of Chung-Buk National University, South Korea. Feasibility Study of Ambient Air Vaporizer for Inchon LNG Import Terminal.

17:30-20:30 Urban Walk (Details during registration)

21:00-22:00 Dinner (Details during registration)

Wednesday 26 June 2013
Cruise: (Details during registration)
Thursday 27 June 2013
Delphi Visit: (Details during registration)

Rama Bhat
Professor, Concordia University, Canada
Chandra Asthana
Associate Professor, Concordia University, Canada
&
Ajinkya Gharapurkar
Professor, Concordia University, Canada

Optimally Adaptive Oleo Strut Damping for UAV Using MR Fluid

The need for the use of Unmanned Aerial Vehicles (UAV) is ever pressing. It would be most desirable to have the same Oleo strut perform optimally during widely different landing conditions. These landing conditions may impose different requirements such as controlling vertical acceleration in a desired manner. As the atmospheric conditions change and the axial load on the strut changes during compression, the ability to control the damping force as function of time would be of great advantage.

In this paper, it is shown that by using MR fluid in the Oleo strut, it is possible to achieve optimal damping performance in every particular landing situation. It is well known, that in a conventional Oleo strut, three different forces act along its length namely, that due to the compression/expansion of gas, that due to the passing of fluid through the orifice and that due to the viscous force. The first is the spring force while the second and the third are the damping forces. The second is proportional to the square of compression or extension rate and the third is proportional to just the rate of compression or extension. By changing the viscosity of the fluid using MR fluid, both the damping forces can be altered in a desired manner.

A simulation based study is carried out to show that by supplying current appropriately, the four parameters defining the damping characteristics of the MR fluid can be altered suitably. Thus an optimal damping force can be obtained for each landing situation and also as a function of time which is impossible to achieve in a conventional passive Oleo strut. The results of this study would lead to a low cost Oleo design as it is possible to use a very simple metering pin design and still have adequate and also time varying damping force. Finally, a different mechanical arrangement for the landing gear is suggested which permits greater linear displacement for the dampers that can be used in smaller and faster UAV's.

Peter Bohm
Professor, University of Applied Sciences Trier, Germany

Damage Analysis on a Broken Crank Shaft of a High Power Pump

Modern tube-membrane-piston pump have a broad-banded operational area and are often used in mines, especially coal-mines. One pump was completely damaged during the operational run, which is an absolutely risk for operators, as the pump shaft is four meter in length with a weight of more than four tons and offers an high potential of kinetic energy. More over it is a financial problem for the manufacturer and an image problem for the producer. Therefore it is useful to analyse the damage and to find out the background details which lead to the breakdown of the pump. For the analysis some methods like visual testing, the mechanical-technology examinations, the bending fatigue strength test, optical and electron beam microscope investigations have to be performed on the test specimen of the shaft made of cast steel 1.7221, G26CrMo4. As the results show no deviations to the declared requirements of the material data, more investigations had to follow. Finally one micro cavity directly under the surface was found in the electron beam microscope. It was responsible for the start of the crack and its propagation. From that point on it was only a question of time, load and the number of cycles on the pump shaft that a fast fracture occurred. Based on this result the producer of the pump shaft changed the producing procedure and applied advanced non-destructive testing methods to detect these micro cavities directly under the surface. A repair of these located indications helps to improve the life time of these pumps shafts enormously.

Akif Bulgak
Professor, Concordia University, Canada

Dynamic Cellular Manufacturing Design with Human Resource Issues

This paper addresses the dynamic cell formation problem and presents an integer nonlinear mathematical model for the design of dynamic cellular manufacturing system (DCMSs) along with human resource issues .The proposed DCMSs model considers several manufacturing attributes such as multi period production planning, dynamic system reconfiguration, duplicate machines, machine capacities, available time for workers, worker assignments and machine breakdowns. The objective is to minimize the total cost comprised of holding cost, outsourcing cost, inter-cell material handling cost, maintenance and overhead cost, machine relocation cost and salary, hiring and firing cost of workers. A numerical example is presented to demonstrate the performance of the model. Future research directions are also discussed.

Max Edelmann
Scientific Assistant, Institute of Automation, University of Applied Sciences, Switzerland
&
Roland Anderegg
Head of Institute, Professor of Mechatronics, University of Applied Sciences, Switzerland

Non-Linear Control of Robot Aided Belt Grinding Manufacturing Process

Due to large tolerances in the production process of faucets, mainly caused by the casting process of the raw part, the desired geometry varies widely. This circumstance yields to raising effort to manually set the parameters for the robot guided grinding and polishing process. Furthermore, each charge of the production maybe needs a new setting which leads to unnecessary production costs. Since faucets are usually design products with a complex geometry consisting of several convex and concave surface elements it is a challenging task for the programmer of the robot to accomplish the requirements for this manufacturing process. Originally the belt grinding machine is a passive system to compensate uncertainties.

Our contribution to solve this problem is an analytic description of the manufacturing process to improve the parameters automatically. The developed model of the grinding process consists of a belt grinding machine with contact wheel and the robot that is holding the component during the whole manufacturing process. By means of Perturbation Theory these systems can be divided into a slow and a fast process. The multi-body dynamic system of the model consists of the grinding machine dynamics which is principally described by the rotating contact wheel, due to eccentric excitation, and the grinding machine-robot-interaction which contains a strong non-linearity: the possible loss of contact. Moreover, the behavior of the robot itself is nonlinear which results in varying compliance that is depending on the current position, orientation and movement of the robot. For the theoretical analytical model these influences are respected. In order to evolve the final system model an experimental setup with different measurements was done and analyzed to parameterize respectively estimate significant parameters within the model. As a consequence of the applied research the passive grinding machine has to be replaced by a fully automated active controlled grinding machine.

Sami Ercan,
Professor, Istanbul Arel University, Turkey
&
Volkan Cakir
Assistant Professor, Istanbul Arel University, Turkey

Decision Making in Learning Organizations

Decision making requires ability and knowledge for any situations, processes, policies or problems that must have results, analysis or conclusion. Decisions also require sensible, reliable, consistent, and valid information about the situation, environment of the cases to be developed. In general, decision makers do not have these capabilities, abilities and experiences for the cases of the enterprise that they are researching. Hence, the organizations must recruit the personnel who have the characteristics of learning organizations they are going to be part of it. In real life it is not so easy to hire an employee with experience and knowledge about learning organizations.

This presentation will illustrate how learning organizations must utilize the characteristics of learning and experiencing in their activities. How firms change and become learning organizations inclusively. Why enterprises must have learning center for incoming workers and present employees for the benefit of the organizations. The presentation will go in detail analysis of learning curves, i.e. monotonically increasing and decreasing productivity curves, S curve, learning plateau, skill and dexterity curves and learning stages. Organizational learning (benchmarking, strategic gathering, joint-venture, learning from customers etc.) shall also be emphasized.

Louis Freund
Professor, San Jose State University, USA

Introducing Service Systems Engineering into the ISE Curriculum

Industrial engineering education has traditionally focused on providing students with the analytic skills and tools that they will be expected to know when employed in the manufacturing sector. However, in the last 25 years, the economies in many nations have been rapidly transferring from being manufacturing based to being service based and consequently, IE jobs in manufacturing have been on the decline. This is particularly evident in the US. At the same time, IE job opportunities in the growing service economy (Health care, leisure, government, transportation of people and goods, education, retail, hospitality and supply chains, for example) have been on the rise. Management of these businesses, though not producing traditional products, urgently seek traditional IE goals of efficiency, effectiveness, and quality in order to be preferred, competitive, and profitable. A new interdisciplinary effort called Service Science, Management, and Engineering (SSME) is emerging to explore the unique aspects of service businesses. Already, it is clear that to be as effective in the service sector as they have been in the industrial sector, industrial engineering graduates will be expected to understand the service sector concepts of co-production, service quality and service quality gaps, service package, servicescape, service experience, service blueprint, the service value chain, and similar concepts bearing on effective and efficient service delivery. Traditional IE methods are very applicable in the service sector, meaning that IE's potentially have a great deal to offer to service sector employers.

At San Jose State University, we have implemented a requirement for undergraduate ISE students to complete one course in Service Systems Engineering. In addition, we have initiated an option in our MS ISE degree program for students to specialize in Service Systems Engineering. This presentation will describe these initiatives in detail, and discuss the integration of this new field of study into our curriculum. In addition, SSME collaborations with the College of Business, IBM, and the International Society of Service Innovation Professionals (ISSIP) will be described.

Sean Gallagher
Associate Professor, Auburn University, USA

Fatigue Failure Theory May Explain Observed Force X Repetition Interaction For Musculoskeletal Disorder Risk

Many epidemiological studies have examined the effects of force and repetition on musculoskeletal disorder (MSD) risk; however, relatively few have examined the possibility that these factors interact. A systematic review of the literature identified twelve studies that evaluated the interaction between force and repetition with respect to MSD risk, ten of which provide evidence of a force*repetition interaction. The interaction follows a consistent pattern, with Low Force tasks show a modest increase in MSD risk with increased repetition, while High Force tasks resulted in a rapid increase in MSD risk. These findings suggest that it may not be appropriate to treat force and repetition as independent risk factors for MSDs, but as factors have a dependency in terms of MSD risk. Interestingly, fatigue failure studies of biological tissues result in a pattern of failure when loaded with high and low force that mirror the MSD risk observed in epidemiological studies. The author suggests in this paper that the force x repetition interaction in the expression of MSDs as observed in epidemiological studies may be representative of a fatigue failure process in affected tissues. The paper will discuss the ramifications of this finding on the development of ergonomics assessment tools and guidelines.

Jerzy Grobelny
Professor, Wroclaw University of Technology, Poland
&
Rafal Michalski
Assistant Professor, Wroclaw University of Technology, Poland

The Use of Scatter Plots for Finding Initial Solutions for Selected Facility Layout Problem Algorithms

The facility layout problem in production engineering is usually defined as assigning specific objects (machines) to defined locations and situating those objects relative to each other. By finding an optimal solution to this problem one minimizes the number of transport operations, the production cycle length etc. Facility layout problems appear also at lower levels of production systems. For instance, within the confines of the ergonomic workplace design the facility layout models are used for minimizing the biological cost of a human being at work. The importance of the research in this field is amplified by empirical studies showing substantial decrease in production costs for optimized layouts well as the employees' efficiency increase at assembly line workplaces after improving the objects' arrangements.

Models and algorithms for facility layout optimization have a long history of research dating back to the 60's of the previous century. Because, from the formal point of view, the search for the optimal solution of the facility layout is NP-hard problem, the heuristic approaches are predominantly applied. During the last two decades the scientific explorations and practical applications are especially focused on such as meta-heuristics as genetic algorithms, simulated annealing or ant colony algorithms. The general tendency in consecutive approaches involves considering more and more real constrains and requirements on the one hand and searching for increasingly efficient methods on the other.

The quality of developed algorithms is most often analyzed by comparing their outcomes. In many heuristic algorithms which by nature are looking for local optima, the optimization results are very sensitive to the input data structure and the initial solution adopted. In this study, a new approach to generating initial solutions for algorithms based on local neighbouring search paradigm is proposed. The suggested methodology takes advantage of a scatter plot idea introduced by Drezner (1980, 1987) and later used by Grobelny (1999). The paper presents the simulation experiments which was designed to

show how scatter plot starting solutions influence the quality of the outcomes produced by selected classical algorithms. The experiments were conducted for tasks having diverse sizes and structures of the relationships matrix. The obtained results are statistically compared with the solutions obtained for randomly generated starting layouts. The experimental data analysis demonstrates usefulness of the proposed approach.

Jan Erik Heller
Ph.D. Student, RWTH Aachen University, Germany
&
Jorg Feldhusen
Director of the Institute, Institute for Engineering Design, RWTH Aachen University, Germany

Enhanced Function Structure Applicability through Adaptive Function Templates

The concept of function structures is well-established within early phases of engineering design as means for clarifying product functions. In addition, it forms the basis for the synthesis of solution principles with morphological boxes.
Besides benefits, disadvantages remain with its application. First, they typically depend on the background their operator. If several persons with diverse backgrounds create function structures, results may be diverging. Second, function structures are non-reversible. It is easy to conceptualize function structures with given products in mind as well as to turn already existing structures into products. However, with unknown context and main functions of products there is no method to elaborate unambiguous function structures reversely from them. For example, engineers unfamiliar with light bulbs could easily guess their primary purpose as create heat. Third, function structures are poorly applicable when mixed levels of product embodiment prevail.
To overcome those shortages, an improved approach is proposed in this paper. It relies on function templates that are based on already existing function carriers. This is achieved by cataloguing function building blocks not only consisting of the function description but also of possible function carriers and all sub-function fulfilled by the carrier. For those sub-functions the same principle of sub-division applies; down to the stage of elementary functions. An algorithm automatically adapts the detailing of templates to match that of the conventionally elaborated functions. The composition of pre-created templates helps generating unambiguous structures. By providing context information due to function carrier inclusion, solutions get traceable. Through the templates' adaptive nature, mixed levels get manageable.
The paper concludes with discussing the approach regarding the development of multi-technology machine tools. Special for that case is the unification of formerly separate machines. To resolve this challenge, function templates are chosen that are based on the technology chain elements of the manufacturing process.

Ping Ji
Associate Professor, The Hong Kong Polytechnic University, P. R. China
&
Xin Ma
Student, The Hong Kong Polytechnic University, P. R. China

Ranking Green Suppliers by Evolutionary Game Theory

Along with the environmental issues becoming increasingly prominent, the significant meaning of saving resources and protecting the environment have been realized by consumers. Development of green supply chain management (GSCM) has become more and more important. Currently, supplier evaluation plays an important role in supply chain management, and in order to evaluate the optimal supplier, many methods from simple to complex have been put forward to solve the problem of supplier evaluation and selection. However, many methods do not concern: (1) recycling the waste from the process of production and (2) developing the long-term relationship between buyers and suppliers once the current procurement cycle is completed. In addition, only a few articles have adopted evolutionary game theory (EGT) to study the relationship between core enterprise and suppliers which could further improve the rough positioning of decision concept model used in the supplier selection [De Boer L, Labro E, Morlacchi P. A review of methods supporting supplier selection, European Journal of Purchasing and Supply Management, 2001, 7(2):75-89.]. Therefore, on the philosophy of GSCM, this paper attempts to apply EGT to analyze the possibility of collaboration between buyers and suppliers during the current procurement cycle. Under the contract restrictions, the game model considers the waste emission recovery cost in supplier group, the remanufacture cost, setup cost and breach fine. Based on the study of the evolutionary stable strategies (ESS) between core enterprises and suppliers groups, we get 3 ESS and further analyze the win-win strategy between two groups. In the numerical example, we evaluate five suppliers which sell five different kinds of raw materials and calculate the enterprise intent of cooperation. Based on the numerical results, we could get the ranking of all suppliers which further demonstrates the feasibility of this model and the results could provide better decision support to the management.

Ho-Yeon Kim
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Cha-Hwan Kim
R&D Division, Korea Gas Corporation, South Korea
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Kyeong-Il Chai
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Yoon-Hwan Kim
Mechanical Engineering of Chung-Buk National University, South Korea
Seok-Ho Rhi
Mechanical Engineering of Chung-Buk National University, South Korea

Feasibility Study of Ambient Air Vaporizer for Inchon LNG Import Terminal

KOGAS (Korea Gas Corporation) has two types of vaporizers to vaporize LNG (Liquefied Natural Gas), which are ORVs (Open Rack Vaporizers) and SCVs (Submerged Combustion Vaporizers). ORVs are used for base load and SCVs done for peak shaving and back-up against thermal degradation of ORVs due to low seawater temperature during winter. Recently, KOGAS has been undergoing difficulties to additionally construct two-type vaporizers due to environmental issues. So KOGAS is considering eco-friendly vaporizers, which have never been experienced in the past, not to use seawater or fuel gas. AAV (Ambient Air Vaporizer) is a strong candidate for clean environment. Hence this work is to investigate its possibility for Inchon LNG import terminal.

KOGAS carried out a bench test to predict the practical performance of AAV under Korean climate conditions with Chung-Buk National University. Thermal mechanism and morphology of frost growth were observed on tube surface. The mechanism was investigated with experimental, analytical, and numerical studies in the presence of forced humid air flow. Especially the experimental results show that the frost thickness varies with various meteorological variables such as air temperature and humidity and wind speed. We could obtain the

performance of AAV under the climate conditions of Inchon and compare AAV with the existing vaporizers.

In the final paper, KOGAS will present the thermal performance of AAV under the climate of Inchon, and its pros and cons, and its economical efficiency including environmental issues. Consequently, KOGAS will verify the feasibility of AAV as an environmental-friendly vaporizer for the existing LNG import terminals in South Korea.

Elisaveta Kirilova
Assistant Professor, Bulgarian Academy of Sciences, Bulgaria
Sophia Yankova
Assistant Professor, Bulgarian Academy of Sciences, Bulgaria
Bilyana Ilieva
PhD-student, Bulgarian Academy of Sciences, Bulgaria
&
Natasha Vaklieva-Bancheva
Professor, Bulgarian Academy of Sciences, Bulgaria

Modelling of Bioconversion of Crude Glycerol from Biodiesel Production by Using Dynamic Artificial Neural Network

Glycerol is a by-product from biodiesel industry. The fermentation of glycerol by different bacterial strains is a complex biotechnological process producing valuable products as organic acids, diols, and ethanol, which are used as reagents in chemical industry. In this study results obtained from biotransformation of glycerol by the help of bacterium from the genera of Pseudomonas, in particular Pseudomonas denitrificans 1625 to formation of 1,3-propanediol (1,3-PD) are represented for the first time.

Mathematical modeling is the approach that can give an answer for the process performance in different scenarios. Having in mind the lack of information about the kinetics of this process we have proposed a dynamic Nonlinear AutoRegressive with eXogenous inputs – NARX Artificial Neural Network (ANN) for the time series modeling of the process.

For that purpose real sets of time-series of parallel batch experiments of the process at different initial concentration of the glycerol have been used. We have developed dynamic ANN model fed with the concentration values of the biomass as independent (exogenous) inputs and 5 and 7 time series interval of past values of the concentrations of the glycerol and 1,3-propanediol fed with tapped delay line of 1 for prediction of their next values (glycerol and 1,3-propanediol). The developed model have been trained and validated with selected for the purpose data sets. The obtained after validation results have shown acceptable coincidence between measured and calculated data.

Vasiliki Kostami
Professor, London Business School, UK
&
Sampath Rajagopalan
Professor, Marshall School of Business, USC, USA

Speed Quality Trade-offs in a Dynamic Model

An important trade-off organizations face in many environments is one between quality and speed.

Working faster may result in greater output and less delay but may result in lower quality and dissatisfied customers. In this work, we consider dynamic models in a monopoly setting to explore the optimal balance among the multiple dimensions of speed, price and wait time. The impact of quality is captured via the market demand potential which is a function of the speed (quality) in the previous period. We obtain several noteworthy results and insights. First, in scenarios where speed may be difficult to change over time (e.g. some automated production lines) but price can be changed, we show that the optimal price charged is such that the demand rate remains constant over time, even though the price and market potential are changing. Further, we identify conditions when the firm will work at a speed that is higher or

lower than a benchmark speed and characterize the behavior of prices over time. Second, in scenarios where a firm may not be able to change prices but can adjust the speed each period, the firm starts at a speed that may be faster or slower than a benchmark speed but converges to it over time. In this constant price case, as the benchmark speed increases, surprisingly the initial speed adopted by the firm is actually lower but increases more quickly thereafter. We also characterize the behavior of price and speed in settings where both can be changed over time. Interestingly, a firm typically starts at a slow speed and increases the speed, price and, demand over time. While the main model in the paper assumes that the firm internalizes the congestion cost, several of our results extend to a scenario where the demand rate is impacted by the congestion level.

Agnieszka Kowalska-Styczen
Assistant Professor, The Silesian University of Technology, Poland

The Impact of a Word of Mouth Mechanism on an Adoption of Changes in the Industrial Organization

In modern organizations, adaptation to the rapid changes in the market is a prerequisite to survival and growth. Many empirical studies have confirmed the assertion that employees' attitudinal and behavioral reactions to change play a major role in success or failure of changes in their organizations. In this change process, people hold an important place, because they are directly and indirectly affected by changes and as a consequence they react differently since each change causes emotional reactions. Simultaneously, the smooth adaptation of employees to changes contributes not only to the improved running of organizations but also to their personal improvement and an enhanced satisfaction. Introducing changes in organizations, it is important therefore, to convince the community of employees to them.

In this study, the process of the spread of an information about change by word of mouth (w-o-m) mechanism is presented. The effects of w-o-m mechanism on the change adoption is investigated, because this is a crucial tool in this sphere. The proposed paper also shows the possibility of modeling the dynamics of conviction to change in the organization, if the basic assumption of this process is the presence of leaders and the their impact on the employees community opinion. Cellular automaton is used as a modeling tool, because it allows to analyze the dynamics of changes in views and attitudes in social groups based on local interactions between people in small informal groups. Informal groups of employees are represented by the von Neumann's neighborhood of different sizes (for r = 1 and r = 2). The employees' environment in the model is shown as a discrete two-dimensional space, which consists of a finite square lattice of cells. Simulations were carried out for a different density of lattice. This possibility allows to take into account the natural fact, that informal groups have a different size, or a larger or smaller number of w-o-m contacts. Precise results of experiments showed high usefulness of cellular automata approach in the discussed area.

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Combination of Forecasts: A Comparative Study Applied to Industrial Series

Often are presented to consumers different alternatives for choosing products which have the same functionality characteristics. Providing right away this item to the consumer involves a judiciously analysis of your productive process and could be crucial in the purchase option. In this context, is fundamental to keep well dimensioned the process involved in the logistical chain, specially the stock levels. In this way, the need to realize more accurate forecasts has stimulated the application and comparison of different modeling techniques, as well as combination methods. Historically, researchers believe that combining forecasts derived from different techniques improves its accuracy, although some studies question whether this is really the best option. This work seeks to verify, for the forecasts with industrial series, if there is difference between the accuracy of the individual forecasts and their combinations, by modeling real series. As individual forecasting techniques are used the Box-Jenkins methodology and RNA model, for the combination of forecasts, are used the methods of arithmetic mean and minimum variance simplified. The performance evaluation of the predictions is obtained by measuring accuracy of MAPE, MSE and MAE. As main result, stands out the predominant frequency in which predictions obtained by the minimum variance method showed superior performance compared to other forecasts.

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Real-time Production Track, Trace & Control Protocol utilizing Radiofrequency Identification Technology at a Blinds Manufacturing Company

The Track, Trace & Control Systems are utilized in the manufacturing processes to detect the status of the system, analyze its performance and help make intelligent decisions to improve it. These systems are an essential element of the business strategy that helps obtaining competitive advantage through a real-time visibility feature. Radiofrequency Identification (RFID) is an Automated Data Identification and Acquisition System that allows collecting and transferring production and business information. This technology uses radiofrequency waves to transfer the data from an electronic tag (RFID tag) adhered to an object, through a transceiver (RFID reader) for the purpose of identifying and tracing the object of interest through the manufacturing process. This paper introduces to the basics of the RFID technology and applies this knowledge to a complex RFID Protocol at a Custom Blind Manufacturing Organization in Mexico. It presents a method to approach a successful RFID protocol providing tools that will reduce the risks of implementation. A derived methodology consisting of RFID Architecture Selection, RFID Network Design & Real Sample Testing and Integration is proposed. The evaluation of the proposals is performed in a controlled environment making use of physical samples tested in a RFID laboratory. Results and technical recommendations are finally presented along with the conclusions and future research opportunities.

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Buyer-Supplier Relationship: The Impact of Service Logistics Level in Customer Satisfaction and Loyalty

Reverse logistics is gaining increasing importance both in academia and among supply chain professionals, not only as a tool in the practice of sustainability, but also for its strategic role in many economic sectors. Several studies show how efficient reverse logistics can reduce costs and provide a competitive advantage to companies. Likewise, electronic commerce, or e-commerce, has shown significant growth in many countries and, due to its very nature, it presents much higher return rates than traditional trade. However, despite the importance of reverse logistics operation for electronic commerce (RLeC), there are no studies which explore this theme in the literature. The objective of this study is to describe and evaluate the process of reverse logistics of the largest online retailer of the Brazilian market, which represents approximately 40% of national e-commerce revenue. This study evaluates the process from the removal of items sold and rejected by consumers, up to the process of recapturing value and determination of a suitable product disposal for retailers and manufacturers. The specific objectives of the study are to identify the strategic changes made in the company in recent years, problems and solutions, the statistics of the RLeC process and future trends for the sector. In short, the article seeks to answer the following questions: How have the reverse logistics processes of a major Brazilian e-commerce company evolved in recent years? What is the return rate and what are the reasons for return in major e-commerce companies in Brazil? What are the main deficiencies in the process of reverse logistics in this company?

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Complexity of Instrumentation in Assessing Virtual vs Real World Hazard Perception Environments

Visual search skills for hazard perception are critical in many domains. They are used by pilots to maintain situation awareness, by doctors reviewing screen images to diagnose health disorders, and security screeners inspecting for hazardous materials. They are also critical to a novice driver's ability to detect roadway hazards. For novice drivers, poor visual search skills can increase the risk for traffic fatalities, which are the leading cause of death for teenagers nationwide. Studies have shown the primary cause of traffic crashes is driver error; the most common of these errors is the failure to perceive hazards in the driving environment. Virtual reality can be used to provide visual search training. However, the success of these training programs depends on the validity of eye-scanning patterns in the virtual environment and on the simulation parameters employed to elicit those patterns.

This paper is part of a larger project that is assessing the validity of search patterns in the virtual world as they apply to the physical realm, and then to identify which simulation parameters are critical for simulator-based hazard perception training. The paper will discuss the complex instrumentation and methodological requirements to understand the process of how hazard perception in the virtual world translates to the real world. Additionally, this paper discusses strategies for integrating the research equipment discussed in the project into the engineering curriculum and various outreach venues.

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A Simulation Optimization Approach for a Multi-Echelon Inventory System with Service Level Constraints

In this paper, we present a simulation optimization algorithm for solving the multi-echelon constrained inventory problem. The goal is to determine the optimal setting of stocking levels to minimize the total inventory investment costs while satisfying the expected response time targets for each field depot. The proposed algorithm is more adaptive than ordinary optimization algorithms, and can be applied to any multi-item multi-echelon inventory system where the cost structure and service level function resemble what we assume. Empirical studies are performed to compare the efficiency of the proposed algorithms with other existing simulation algorithms.

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Reliability Analysis for Financial Compliance Analysis

The finance industry has progressed from pit traders that executed trades manually in a pit to a highly automated industry. This progression started with electronification of markets and was accelerated with the creation of Financial Engineering as a sub-specialty in Industrial engineering. The Industrial engineering tools that were quickly accepted was Optimization, Simulation, Stochastic process modeling, Markov chains, Time Series, etc. These tools were used to create the current financial industry where 95% of the trades are auto executed. The industry is now one of the most automated industries in the world based on the billion of buy or sell messages sent per day.

The two areas that still need to be transferred between Industrial Engineering and Financial Engineering are Quality and Reliability/Safety. The quality tools are currently being transferred via the creation of AT9000. During the creation of AT9000 it has become apparent that the reliability/safety tools need to also be transferred. In this paper we describe and explain the need of creating a Reliability Modeling framework that includes Baysian decisions to analysis the multiple new regulations that are being proposed by the various world regulators. This paper will show that without this type of modeling many of the new regulations will make the overall system more fragile during a failure of a single component versus more reliable.