First BUE Annual Conference & Exhibition
BUEACE1 2016
7-9 November

Book of Abstracts
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Keynote Speakers
Amr El-Abbadi is a Professor of Computer Science Department at the University of California, Santa Barbara. Prof. El Abbadi was Chair of the Computer Science Department at UCSB from 2007 to 2011. He has served as a journal editor for several database journals, including, currently, The VLDB Journal and IEEE Transactions on Computers. He has been Program Chair for multiple database and distributed systems conferences. He has served as a board member of the VLDB Endowment from 2002—2008, and is currently a member of the Executive Committee of the Technical Committee of Data Engineering (TCDE). He has published over 300 articles in databases and distributed systems. Prof. El Abbadi has been elected as IEEE Fellow, ACM Fellow and AAAS Fellow.

Research

Prof. El Abbadi's research addresses some of the most fundamental problems facing us at the beginning of the twenty first century, namely, how to manage the ever increasing amount of data humanity is generating and studying. The issue of scalability of data is encountered in a wide variety of applications, including astronomy, biology, physics, as well as network analysis and data mining. At the same time, as people and enterprises depend increasingly on storing private data in databases and computers, issues of privacy and security become of paramount importance.

The main challenge is to efficiently manage this large amount of growing data so as to respond in a timely and secure manner to the queries posed by scientists, biologists, engineers, analysts, etc. The focus of Prof. El Abbadi’s research is to explore novel methods to solve these scalability problems in a reliable, efficient and privacy preserving manner. His approach uses novel techniques, and can be categorized as methods using novel hardware solutions, methods using efficient mathematical tools, and methods using good old software solutions for storage management. Prof. El Abbadi's research is grounded in specific applications that ensure that his results are practical and can have the strongest impact of the real world.
Dr. Arto Kiviniemi, Professor of Digital Architectural Design at the School of Architecture in the University of Liverpool, has MSc in Architecture from Aalto University, Helsinki, and PhD in Civil and Environmental Engineering from Stanford University, California.

In his early career, 1972-1996, Arto worked as a designing architect. From that period he has twelve 1st prizes and several other awards in architectural competitions as the main assistant and office manager of architect Arto Sipinen. His main projects include Tapiola and Imatra Cultural Centres, Mikkeli Concert Hall, Raisio Municipal Hall and several buildings of the Jyväskylä University.

Since 1996 Arto has developed integrated Building Information Modelling (BIM) both in Finland and internationally. 1997 Tekes (Finnish Funding Agency for Technology and Innovation) invited Arto to lead the national R&D programme “Vera – Information Networking in the Construction Process 1997-2002”. The programme created the foundation for Finland’s position as one of the leading countries using BIM in the industry. In May 2010 Arto moved to UK and worked first as a Professor at the School of Built Environment in the University of Salford until he moved to his current position at the University of Liverpool in September 2013.

Internationally Arto’s main activities have been related to the International Alliance for Interoperability, now known as building SMART International, where he has acted as the Chairman and Deputy Chairman of the International Council and Executive Committee and as the Chairman of the International Technical Management Committee. Currently he is a member of the International Technical Advisory Group.

Arto has presented 140+ keynote and invited lectures in international seminars and conferences around the world since 1996. For his international merits in developing integrated BIM Arto received the Fiatech CETI Outstanding Researcher Award in USA in March 2009 and the Order of the Knight of White Rose of Finland in December 2012.
Dr. Michele Meo’s primary research interests are NDT and structural health monitoring of metallic and composite structures; damage growth modelling in nano/macro materials, impact, blast and crashworthiness and smart materials and structures.

Specific topics of interest include

- The development of nonlinear acoustic/ultrasound methodologies to detect damage in aerospace and civil structures
- novel materials for improved impact properties
- intelligent materials with multifunctional properties
- finite element/meshless methods for linear and non-linear structural problems, applied both to aircraft and civil structures with special emphasis on impact, blast and crashworthiness of composite structures.

Professional Experience

- Senior Lecturer in Polymer & Composite Engineering Material, University of Bath, 2006
- Lecturer in Composite Material, Cranfield University, 2004
- Research Fellow, Cranfield University, 2000
- Research Assistant, Cranfield University, 1997
- Stress Engineer, Novotech (Naples, Italy), 1994 to 1997
Tariq Sattar

Professor Tariq Sattar is a pioneer in the development of robotic NDT.

He leads the research in this area in his role as the TWI chair and Director of the London South Bank Innovation Centre (LSBIC) based in Cambridge.

LSBIC is a collaboration with TWI Ltd, the National Structural Integrity research Centre and London South Bank University to research and develop automation and robotics for non-destructive testing.

The Centre focusses on developing mobile wall-climbing and swimming robots that provide access to very large safety critical structures to deploy a range of non-destructive testing techniques. These robotic systems have addressed the problems of performing inspection:

- In oil and petrochemical storage tanks to detect corrosion and pitting on the floors and walls of the tanks while submerged in liquids
- In nuclear plant to test welds on pipes in the primary circuit and in nozzles on pressure vessels while submerged in water
- On aircraft fuselage and wings to detect corrosion and cracks along rivet lines
- Inside floating production oil storage tanks in ships to test welds while submerged in oil
- On the hulls of ships to test welds during manufacture in dry docks
- On large steel plates to detect defects such as cracks and inclusions in the plate after manufacture
- On wind turbine blades with a climbing robot
- On aircraft turbine blades with a portable 7 DOF scanning arm
- On large buildings while operating on brick, concrete and glass surfaces

His research has won eleven awards for best papers and industrial innovation in the field of robotics.

His work was selected by the Royal Society for its 350th anniversary summer science exhibition and again by the Royal Academy of Engineering as an interactive display in its zone at the Big Bang event, ICC ExCel Centre.

Research results have been reported in over 120 publications, plenary keynote lectures, corporate power outages conferences, and mechatronics lecture series.
Dr. Sri Sritharan joined the Department of Civil, Construction and Environmental Engineering (CCEE) at Iowa State University as an Assistant Professor in December 1999. He became an Associate Professor in 2005 and Full Professor in 2010. He served as the Director of Graduate Education (DOGE) and Associate Chair for Research and Graduate Affairs for the CCEE department from 2007 to 2012, and the faculty lead for the Wind Energy Initiative of the College of Engineering from 2011 to 2014. He became the Grace Miller Wilson and T. A. Wilson Endowed Engineering Professor in 2008.

Dr. Sritharan earned his BSc degree with First class Honors in civil engineering from the University of Peradeniya in Sri Lanka and MS degree with Distinction from the University of Auckland in New Zealand. Prior to pursuing his PhD at the University of California at San Diego (UCSD), he worked as a Scientist in the Engineering Seismology section of the Institute of Geological and Nuclear Sciences (GNS) in New Zealand for more than four years. His work at GNS focused in the areas of microzonation, attenuation of ground motions and understanding the behavior of instrumented structures subjected to earthquake loading. He received his PhD in Structural Engineering in 1998 under the guidance of Professor M. J. Nigel Priestley. Prior to joining Iowa State University, he served as an Assistant Project Scientist at UCSD and worked primarily on the PREcast Seismic Structural Systems (PRESSS) program.

His research interests include Earthquake-resistant design and analysis of structures, precast/prestressed structural systems, soil-foundation structure interaction (SFSI), Ultra-high performance concrete (UHPC) and special topics in Wind Engineering and Wind Energy Systems. His research projects have been funded by the National Science Foundation, Department of Energy, National Oceanic and Atmospheric Administration, U.S. Department of Agriculture, Transportation Research Board, Federal Highway Administration, Department of Transportation in Alaska, California, and Iowa, Iowa Energy Center, non-profit institutions, and private industry.
Dean Vucinic, Professor at the Vrije Universiteit Brussel (VUB), is member of 2 departments: Mechanical Engineering and Electronics & Informatics, responsible for the Research and Development (R&D) in multidisciplinary engineering and computer science domains. His Ph.D. thesis became a book in 2010, ISBN 978-3-8383-3500-1. In early 90’s he developed “CFView - Computational Field Visualization System”, first-time-ever interactive visualization software adapted to numerical simulation solvers, completely based on the object-oriented technology, and fully implemented in C++.

With almost 30 years at VUB, he has successfully participated in more than 20 European projects under the European Frameworks (H2020), EUREKA (ITEA) and Tempus (ERASMUS+), where more than 20 PhD-s based their visualization and data analysis applying CFView. He is author of more than 50 scientific papers in the international reviewed journals and conferences proceedings. Member of several International Scientific and Technical Conference Committees and Editorial Boards of International Journals. He is the European Commission expert in H2020. Member of AIAA, IEEE, ACM, SAE & ASME.
Keynote Lectures
The challenges of Practical Big Data Management in the Cloud

Amr El-Abbadi

Large scale, globally dispersed data centers, also known as the Cloud, are the common eco-system for storing ever-increasing big data sets. Managing and manipulating large data sets raise significant fault-tolerant, consistency and privacy concerns that have sometimes resulted in pragmatic sacrifices in functionality, efficiency or privacy. In this talk, we will explore various approaches to mitigate these shortcomings to ensure consistent data management both within a single data center as well as across multiple data centers. Consistently managing data across multiple data centers is crucial to ensure both high performance as well as fault-tolerance in the face of catastrophic disasters. In addition to failures, data centers are constantly exposed to an increasing number of non-trivial adversarial threats. Traditional cryptographic methods either limit the functionality of the data, or significantly increase retrieval costs. We will highlight some novel approaches that ensure efficient privacy preserving access to data in the Cloud.

Potential and Challenges in Using Building Information Modelling for Heritage Buildings

Arto Kiviniemi

Use of Building Information Modelling (BIM) is rapidly increasing in the design and construction. Because of the benefits of BIM some public owners have mandated its use in their projects already for years, e.g. General Services Administration (GSA) in USA since 2006 and Senate Properties in Finland since 2007. In the UK the use of BIM became mandatory in all governmental projects in April 2016 after a thorough preparation phase since 2011. However, the use of BIM is still mainly seen relevant for new buildings, and often for large and complex projects only, and other areas like Facility Management (FM) or Historic/ Heritage Building Information Modelling (HBIM) are still in their infancy and examples of real practical use are scarce although some research exists.

One of the reasons for the underutilization of BIM for existing buildings seems to be the common misunderstanding of BIM as a 3D model, instead of Building Information Management (or perhaps more correctly Asset Information Management, AIM) focusing holistically on required lifecycle information instead of geometrical features. Because 3D information is a relatively small part of the necessary maintenance or heritage information, it is not easy for the owners or people responsible of the assets to see the benefits outweighing the costs of gathering the information and embed it into the model.

The presentation will discuss the potential and challenges in using BIM for heritage buildings looking at the combination of different techniques (e.g. BIM, GIS, databases, existing documents, semantic web), creating links between appropriate information sources rather than trying to embed all data into a single model, and focusing on the information content rather than the geometry.
A nonlinear acousto-ultrasonic based structural health monitoring system for aerospace

Michael Meo

The objective of this work was to demonstrate the feasibility of nonlinear vibration/ acoustic/ ultrasonic diagnostic tools to be implemented in a structural health monitoring (SHM) system for detecting, locating and imaging damage in aerospace structures. Examples of the capability and limitations of the proposed SHM process to detect and image damages and flaws in aerospace structures such as corrosion and barely visible impact damage (BVID) are presented for various metallic and composite structures. The results showed that the proposed nonlinear acousto-ultrasound methods is highly accurate in assessing the presence and magnitude of damage with very promising future NDT and structural health monitoring applications in a real industrial aerospace environment.

Safeguarding critical infrastructure with Robotic inspection, opportunities and challenges

Tariq Sattar

Reliable Non Destructive Testing (NDT) is vital to the integrity, performance management and sustainability of capital assets in safety critical industries such as oil and gas, aerospace, transportation, power generation and offshore and subsea operations. The talk will explore opportunities to improve the NDT of industrial structures and decrease the cost of inspection by automating the NDT with mobile robots. The challenges of developing mobile wall climbing and submersible robots will be presented that can provide access to test sites on very large vertical structures or structures located in hazardous environments thereby eliminating the large expense of erecting scaffolding or lengthy preparation for rope and platform access before inspection can start. Some of these developments provide the possibility of saving costs by reducing outage times or carrying out the NDT in-service thus preventing expensive outages. The presentation will show climbing and swimming robots developed to detect weld and corrosion defects on ship hulls, floating platforms, mooring chains, petrochemical storage tanks, pressure vessels, concrete structures, wind blades and aircraft wings and fuselage.
Wind power, which led the available technologies in new power generation in 2015, is the fastest growing source of electricity in the world today. In 2015, about 63 GW of wind power was added, bringing the total installed global wind energy capacity above 430 GW. Asia, Europe, and North America are responsible for 95% of the installed wind power, while the growth of wind energy in Africa, Middle East, Latin America and Pacific region are relatively low. Egypt added 200 MW in 2015 to elevate its installed wind power to 800 MW, which contributes to less than 1% of its electricity demand. The wind energy is expected to grow continuously and reach nearly 800 GW by 2020. This will enable countries such as Germany, United Kingdom, and United States to produce 10 to 20% of their electricity from wind. Egypt also has a similar goal and has set a target to produce 12% of energy from wind by 2020.

In addition to the advancements of wind energy technologies, other factors contribute to continuous growth of wind energy. They include: 1) policies and government incentives towards climate control and renewable energy; 2) reduced energy cost; and 3) a relatively stable market. Even though the cost of energy is reduced, not every region in a country can rely on producing wind power. This is due to insufficient wind resources at commonly used hub heights of 80 to 100 m. To overcome this challenge, low speed wind turbines are being introduced together with taller towers and larger rotors. One challenge with increasing the tower height and rotor diameter is that they introduce transportation and logistical challenges, which cannot be overcome cost effectively. For these reasons, newer technologies have been developed to harvest wind energy at elevated hub heights. This presentation will provide global perspectives on the current and future wind power and discuss a tower technology that is developed to access wind energy at elevated hub heights.
Towards realistic and efficient heart blood flow simulations
Dean Vucinic

Today, to advance in the treatment of the heart diseases, the new software tools are needed, in order to realistically simulate the heart blood flow, and efficiently analyze the obtained results, which are dynamically changing during the heartbeat, and in addition, being very specific to a patient.

In this lecture, a special consideration is given to the automatic grid generation applied in the Computational Fluid Dynamics (CFD) techniques, as found essential for the advancement of the proposed numerical simulations, which require to have a very precise time-dependent heart geometry defined.

For the leaving heart blood flow, the CFD simulation results analysis is made possible by using advance visualization techniques, which will enable doctors to diagnose faster and more precise a heart disease of the investigated patient. For example, if the patient requires the surgical operation, such software tools will enable the surgeon to develop the operation plan for this very specific patient.

This advanced procedure, which takes into account the very exact and specific patient heart data, is expected to remove errors coming from a subjective doctor’s interpretation of the patient heart problem. Thus, avoiding errors, which could come from applying the general practice doctor’s experience.

Before operation, the surgeon requires, not only to see the behavior of the heart blood flow, but also needs to understand how the heart will behave after the operation is completed. The analysis, of the real heart blood flow, will enable the surgeon to select the most appropriate operation steps between the alternatives he/she has, and thus, before the operation she/he can make the correct decisions about the specific and detailed operation steps to be performed. It is envisaged that by applying such approach, the heart operations risks will be reduced.

In this lecture, the numerical simulations results based on the real heart geometry are presented: (1) CFD based computations with the FlowVision code and (2) Finite Element Model (FEM) based computations with Abaqus code, and (3) both results are discussed and compared. In the first approach, the real heart geometry is created from the MRI/MRT scans, and in the second approach, the whole heart behavior is simulated in the frame of the Leaving Heart Project.

The both approaches are representative to be considered for advancing the software tools towards realistic and efficient heart blood flow simulations, as they both take into account the real patient heart geometry, to be considered for medical treatment.
# Abstracts

## Structures, Built and Natural Environment -SBNE01- Low Energy Buildings

**Session Chairs:** Marwa DABAIEH & Samer ZAWAYDEH

Tuesday November 8th - Time: 1:30 PM – 3:15 PM

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<td>Marwa DABAIEH &amp; Salma ELBANNA</td>
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<td>Carbon mapping for residential low carbon retrofitting</td>
<td>Marwa DABAIEH, Inji KENAWY, Walaa SALAH &amp; Marwa ADEL</td>
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<td>Rooftop Garden with Recycled Materials</td>
<td>Monica Zacharia &amp; Marwa Dabaieh</td>
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A Rehabilitation Proposal towards a Low Carbon Living Complete Street: A case from Cairo

Marwa DABAIEH1, Salma ELBANNA2,

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Cairo is one of the vibrant cities with chaotic car dominating streets. There is amounting traffic related death rates due to lack of proper designed pedestrian safe routes. The sidewalks are for much more than pedestrian transport. Informal activities like street vendors and cafes occupying part of pedestrian platforms are uncontrolled creeps that obstruct pedestrians and sometimes paralyze car flow. In addition, sidewalks sometimes act as an informal marketplace, a workshop, a billboard and a car parking lot.

Throughout this study, an understanding is drawn for the challenge in introducing best practices and trends in the provision of high-priority and transformative initiatives for the right to a low carbon complete street in Cairo. The study tackles mobility and accessibility while facing the invasive threat of informal street vendors and the informal commercial activity phenomena. We investigated travel demand drivers and determinants of possible shifts in travel behaviour. The study employs a case study methodology and aims to suggest an alternative low carbon living complete street design proposal to effectively enhance the street activities. We choose Tal’at Harb Street in downtown Cairo as a pilot case. Our proposal covers sustainable smart mobility solutions with a main focus on pathways to increase locals’ usage of public and active transport. The study ends with recommendation for developing a framework for supporting effective investment decisions and implementation of the design proposal as a pilot case. We aim at improving awareness of the right to a complete street towards a low carbon mobility practice.

Keywords: Street Vending, Living Complete Street, Low carbon, Smart Solution.
Carbon mapping for residential low carbon retrofitting

Marwa DABAIEH*1, Inji KENAWY1, Walaa SALAH1, Marwa ADEL1

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The Egyptian government has set a target to reduce CO₂ emission by 20 % by the year 2020. 50% of carbon emissions is mainly from the residential sector due to energy inefficient building stock. The carbon emissions are rapidly increasing as rules and regulations are not supporting any reduction in carbon foot prints by using energy efficient building methods or using renewable as zero carbon and clean energy sources. In addition the Egyptian government had gave permission for using coal as a fuel for power station which ironically makes the situation even worse with no hope to reach the planned target. While the design of new zero carbon buildings has been researched worldwide, the potential for zero emission retrofit is less well known in Egypt. As the vast majority of buildings that will exist in 2050 have already been built, and the interactions of the carbon emission reduction methods, such as fabric improvements, occupant behavior and renewable technologies in the urban retrofit design process need to be researched further.

This study aims at designing a carbon mapping tool to be used to measure the carbon foot print of residential buildings in Egypt. The project is built on a comprehensive database of embodied carbon inventory data for conventional building materials in Egypt and energy consumption per meter square based on average calculations of annual energy bills for the last 10 years for different neighborhood connected to the main grid. This tool is also considered a decision support tools for building designers, planners and developers. Moreover it identify where potential research opportunities exist. The carbon emissions data in this tool can also be used in a 3D Building Information Modelling (BIM). This will enable to calculate and visualize the carbon emissions of specific residential development and retrofitting projects during their planning and design development stage. In addition it will help in measuring the impact of housing retrofit and using renewable technologies for energy production. It serves also to anticipate occupant behavior to form a grid for de-carbonization on town planning and city level. This tool is based on a pilot project for one of Cairo’s neighborhoods in order to test and validate the data and calculation methods. It will be in a form of user-friendly web application that allow architects and planners and even laymen to make effective decision for low carbon retrofitting. The tool is an open access source and can be adjusted according to geographical locations as it is connected to GIS maps.

**Keywords:** Low carbon retrofitting, de-carbonisation, carbon foot print, residential buildings, GIS.
Implementing Codes and Regulations as a Driver to Low Energy Buildings – Case Study

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Energy is currently expensive and not accessible to all people on earth. The prices of electricity in Jordan increased in an exponential manner during the past few years, which drove large consumers to seek energy retrofit and renewable energy solutions to be implemented at their buildings.

This paper will show the increase in electricity prices in Jordan during the past 15 years, and the development of regulations for buildings consuming more than 50toe/year to implement all the Jordanian Energy Codes related to buildings. A list of the codes will be presented and a discussion about the Jordan Thermal Insulation Code, Jordan Energy Efficient Building Code, and the Jordan Green Building Guide requirements will also be presented.

A case study on the renovation of existing building by installing thermal insulation at roof, replacement of windows, installation of Solar Water Heater and Installation of PV system to cover the annual electricity consumption will be presented. The payback period and carbon emissions avoided from the implementation of the energy efficiency and renewable energy measures will also be presented. These simple and economic solutions will be a driver for change for similar buildings. It will ensure that the future development of the building sector toward clean technology, low energy and low carbon economy.

Keywords: Codes, Regulations, Thermal Insulation, PV, Efficiency, Energy, Economic, Emissions.
Cooling the Future: Bridging architectural aspects from the past with modern energy efficient paints

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Areas along the Mediterranean basin exhibit extreme weather, during the summer months with persistent high heat and humidity. One of the main building material used, was coral aggregates with walls that were plastered and painted white. Many settlements and buildings indicate a harmonization with the Mediterranean continental climate. They are found very often on hillsides facing east, south, or southwest. Typical buildings consist on single cubical structures with white washed thick masonry walls.

Enhanced solar reflectance is a technique that the desert uses to deal with high levels of solar exposure. Light coloured soils and sands of desert environments reflect away a significant percentage of incoming solar radiation before it is absorbed and transformed to thermal radiation and heat. The use of whitewashed coatings throughout the Mediterranean and Middle East, combined with other passive cooling strategies could significantly reduce both indoor and ambient temperatures, making such climates comfortable without mechanical air conditioning.

Functional, durable and affordable paint solutions, based on natural binders (i.e. lime), pigmentation (i.e. ochre) and/or limitless resources (i.e. sand), they perform excellent water vapor permeability and solar reflectance values, without sacrificing colours, enable the improvement of thermal comfort conditions and the mitigation of air-condition use, driving to lower carbon dioxide emissions and to energy savings.

Keywords: High solar reflectance, passive cooling, vernacular architecture, functional paints, historic buildings, urban heat island, energy savings, thermal comfort.
Rooftop Garden with Recycled Materials

Monica Zacharia\textsuperscript{1*}, Marwa Dabaieh\textsuperscript{2}

\textsuperscript{1}Master student at Cairo University, monica.michel.303@gmail.com\textsuperscript{2}British University in Egypt, Marwa.Dabaieh@bue.edu.eg

In 2015, the volume of annual municipal waste in Egypt was amounted to around 22 million tons and this figure is forecast to rise by 3.4\% each year. It is estimated that only 60\% of waste is collected and less than 20\% of this percentage is recycled. The cycle of waste management started from sorting, collection, transportation, and recovery and disposal systems. One of the biggest problems comes from the first two steps which are sorting and collection. This study is presenting an experimental action research showing a living lab trial for recycling and reusing the municipal waste. We showed a proof of concept model for designing and building a simple rooftop garden for house owners acting as a recreational area and a safe place for children to play.

This model has been implemented in Shoubra, Cairo, by using waste. No additional materials were used, low tech approach was adopted using manual tools and simple electric devises for fixations. The main objectives of this experiment, is to first build a bridge between architecture design and solid waste and turning the spot to alternative building materials. The second is to raise the environmental awareness for waste value and the importance of sorting waste from source to develop household waste collection mechanism. Third, is to encourage local food production through roof top farming using compost from household organic waste. Fourth, is to decrease direct heat gain on roof tops which consequently will reduce cooling loads. After 18 months monitoring, some direct returns of this experiment were observed like home owners learned how to sort their waste and produce compost domestically. The study will end by evaluating all such benefits and showing the results of monitoring the structure stability of the roof top pergola structure and furniture together with their resistance to climate conditions.

\textbf{Keywords}: rooftop, recycling, reusing, upcycling, municipal waste.
### Advanced Mechanical Technologies-AMT01-Internet of Things-Engineering Applications

**Session Chair:** *Abdel Moez BAYOUMI & Travis EDWARDS*

**Tuesday November 8th - Time: 1:30 PM – 3:15 PM**

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<td>Mechanical fault detection and classification using pattern recognition based on bispectrum algorithm</td>
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<td>Determining Auxiliary Power Unit Fuel Efficiency for Multiple Types of Nano Oils</td>
<td><em>Patrick FOLK, Thomas HARTMANN, Rebecca FECTEAU &amp; Abdel M. BAYOUMI</em></td>
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Internet of Things – A Predictive Maintenance Tool for General Machinery, Petrochemicals and Water Treatment

ABDEL-MOEZ BAYOUMI
1
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Predictive Maintenance is a goal-driven process that offers the highest attainable level of asset proficiency. The Internet of Things methodology can be used to develop predictive maintenance tools for the advancement of predictive maintenance in industries such as general machinery, petrochemicals, and water treatment. Even though these industries involve differing maintenance needs, the same Internet of Things methodology for predictive maintenance can be applied to all of them. It is important to advance the maintenance practices of these industries because they play a vital role in our lives. In the area of general machinery, components have usually been repaired on a time-based schedule which leads to unnecessary maintenance repairs and increase in maintenance costs. The petrochemicals industry is facing large growth and with that a need for efficient maintenance practices. One important area of the water treatment industry is the desalinization of water. In order to keep the cost of desalinization down, unscheduled maintenance needs to decrease. Predictive maintenance can address all of these problems and lead to a reduction in unscheduled and unnecessary maintenance. An effective predictive maintenance program does not only involve using the best technologies, but also addresses the training and education of everyone involved with the maintenance program. This training can be done through higher education courses, shorter training and certification courses, and also through demonstrations. Predictive maintenance tools designed with the Internet of Things methodology can be used implement predictive maintenance and to educate users.

Keywords: predictive maintenance, internet of things
Internet of Things – A Complete Solution for Aviation’s Predictive Maintenance

Travis EDWARDS1, Lester EISNER MG (U.S.A Ret.)2*

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2 University of South Carolina, eisnerl@mailbox.sc.edu

The University of South Carolina has been involved in research for the US military for helicopters and rotary aircraft for over 18 years focused on optimizing aircraft uptime and flight readiness by leveraging condition-based maintenance (CBM) or more commonly known as predictive maintenance. This type of maintenance differs from other classical styles (reactive and preventive) in that it has a high reliability and a low cost. The foundation of predictive maintenance in any application is data collection and storage. It begins with applying tools such as natural language processing of historical maintenance records to determine the most critical components on the aircraft. Data mining of previously collected sensor data is then used to establish the most reliable types of condition indicators (CIs) that monitor the critical components. These thresholds from the CIs can be modified over time as more data is collected. Once a data collection scheme is in place, prognostics can be used to determine the remaining useful life of a component. This helps reduce the amount of unnecessary maintenance actions on the aircraft, as well as reducing the inventory of components needed for the aircraft to operate. Similarly, leadership will gain a better understanding of their aircraft and will be equipped with more knowledge when trying to determine what aircraft should operate for a certain mission. After this maintenance scheme has been setup, the Internet of Things can be leveraged to allow the entire process to operate within a single environment. This further develops the methodology and actions can be executed more quickly than if they were performed individually. The expected benefits and future development of these practices will never come to fruition unless personnel are properly educated and trained. Developing a culture of predictive maintenance practices in an aviation environment is necessary to ensure success of this methodology.

Keywords: Predictive Maintenance, Aerospace, Internet of Things, Asset Management, Prediction Algorithms, Natural Language Processing, Data Mining
Mechanical fault detection and classification using pattern recognition based on bi-spectrum algorithm

Michael R. Habib\textsuperscript{a}, Mohammed A. Hassan\textsuperscript{a}, Rania A. Abul Seoud\textsuperscript{a}, Abdel M. Bayoumi\textsuperscript{b}

\textsuperscript{a} Electrical Engineering Department, Fayoum University, Fayoum, Egypt
\textsuperscript{b} Mechanical Engineering Department, University of South Carolina, SC, USA

Higher order spectral analysis of vibration signals is an efficient tool in condition monitoring and fault detection and diagnosis of rotating machinery. In this paper, features extracted from vibration bi-spectrum are used in fault classification of critical rotating components in the AH-64D helicopter tail rotor drive train system. Different classifiers are used to compare the performance of the proposed algorithm based on bi-spectrum to the traditional algorithms based on linear auto- and cross-power spectral analysis techniques. Principal component analysis (PCA) is used to reduce the size of features extracted from vibration bi-spectrum and linear spectral analysis, then the reduced set is used to train different classifiers. Different criteria are used to evaluate and compare the proposed classification algorithm to other classifiers. The proposed method is verified using real-world data collected from a dedicated AH-64D helicopter drive-train research test bed at the CPM center, University of South Carolina. The proposed algorithm increases the accuracy of fault classification to 96.88%, precession to 95.83%, sensitivity to 95.83%.

\textbf{Keywords:} Vibration Analysis; Bispectrum; Condition Based Maintenance; Machine Learning; Principle Component Analysis; Logistic Regression; Rotating Machinery Fault Detection
Determining Auxiliary Power Unit Fuel Efficiency for Multiple Types of Nano Oils

Patrick FOLK, Thomas HARTMANN, Rebecca FECTEAU*, Abdel BAYOUMI

University of South Carolina
*Fecteaur@email.sc.edu, Bayoumi@sc.edu

The effects of using nano oils in an UH-60 Blackhawk Auxiliary Power Unit (APU) were studied in order to determine the nano oil mixture that best decreased fuel and power consumption. The nano oils in this study were tested and compared against the performance of a conventional baseline oil. The first nano oil mixture contained proprietary nanodiamond particles and the second nano oil mixture contained zinc sulfide, boron nitride, and graphene particles. AeroShell 560 was used as the conventional baseline oil with which nano particles were added. In addition to extensive oil testing with the APU, the oils were tested in an AH-64 Apache Intermediate Gear Box (IGB). Testing was conducted on two separate AH-64 test stands, one applying torque through an absorption motor and one where no torque was applied. These tests provided additional data for determining the effects of the lubricating properties of the oils by measuring vibration and temperature. This research and subsequent calculations suggest that AeroShell 560 turbine oil containing zinc sulfide, boron nitride, and graphene particles can provide significant improvements in fuel efficiency and friction reduction. Oil containing nanodiamond particles also improves performance of the APU and IGB, but to a lesser extent than the graphene blend nano oil.

Keywords: Auxiliary Power Unit, Nano Oil, Fuel Efficiency, Small Engine.
**Emerging Technologies in Informatics-ETI01- Cloud Computing**

Session Chair: **Ayman BAHAA**

Tuesday November 8th - Time: 1:30 PM – 3:15 PM

|   | 1:30 – 1:50 | A modified cloud-based cryptographic coprocessor for cloud data storage alteration detection  
*Basma Hathout, Samy Ghoniemy & Osman Ibrahim* |
|---|---|---|
| 2 | 1:50 – 2:10 | Integrated Education Management System via Cloud Computing A case study on the British University in Egypt  
*Eslam ABO GAMIE, Samir ABOU EL-SEoud & Mostafa SALAMA* |
| 3 | 2:10 – 2:30 | Security Problems in Cloud Computing  
*Rola MOTAWIE, Mahmoud EL-KHOULY & M. Samir ABOU EL-SEoud* |
| 4 | 2:30 – 2:50 | Malware Detection in Cloud Environment (MDCE)  
*Safaa ALATABBI, Mahmoud EL-KHOULY & M. Samir ABOU EL-SEoud* |
| 5 | 2:50 – 3:10 | A Cloud-based Malware Detection Framework  
*Eman Ahmed, Amin Sorour, Mohammed Sobh & Ayman Bahaa-Eldin* |
A modified cloud-based cryptographic coprocessor for cloud data storage alteration detection

Basma Hathout, Samy Ghoniemy and Osman Ibrahim

In spite of all the advantages delivered by cloud computing, several challenges are hindering the migration of customer software and data into the cloud. On top of the list is the security and privacy concerns arising from the storage and processing of sensitive data on remote machines that are not owned, or even managed by the customers themselves. The loss of such physical possession of the outsourced data threatens the integrity of this data. A substantial number of varying schemes and frameworks have been explored and deployed to handle the data integrity issue, but none of these schemes and frameworks dealt with the actual document’s content or established a secure execution domain in the computing cloud.

In this paper, a homomorphic encryption-based cryptographic coprocessor is proposed to handle the cloud data integrity problem. The proposed cryptographic coprocessor is based on Paillier scheme for high encryption and decryption efficiency, low expansion factor and supports multiplication operation by a constant. The proposed cryptographic coprocessor is also supported by user-configurable software protection and data privacy categorization agents, and a set of accountable auditing services required to achieve legal compliance and certification.

This scheme was tested using different text documents with different file sizes. Testing results showed that as the size of the document increases, the size of the generated key increases dramatically causing a major problem in the decryption process especially for large documents. This leaded us to a modified security architecture that adds two major autonomic security detective agents to the multi agent architecture of cloud data storage. In this paper, we focus on the first agent namely (Automated Master Agent, AMA) that is added to the Multi Agent System Architecture (MASA) layer (cloud client-side) by which any changes happen in the document are mapped in a QR encoded keyprint (KP). Experimental results after integrating this agent showed a 100% alteration detection accuracy and a superiority in extracting the KP of large and very large size documents which remarkably exceeds the currently available products and leverage the tamper-proof capabilities of cryptographic coprocessors to establish a secure execution domain in the computing cloud that is physically and logically protected from unauthorized access.

Keywords: homomorphic encryption; cloud data storage security; document key print
Integrated Education Management System via Cloud Computing

A case study on the British University in Egypt

Eslem ABO GAMIE\textsuperscript{1*,} Samir ABOU EL-SEOUDE\textsuperscript{2,} Khaled NAGATY\textsuperscript{3}

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Systems integrity is one of the most important - yet complicated topics in Higher education domain. The demand for improved and integrated digital campus had been increasing dramatically during the last decade; that is why educational technology professionals continue to think more critically about how their students, academics, processes and technology can work together homogeneously. The British University in Egypt suffers from lack of systems integrity, for instance the eLearning, the eLibrary and Students record system (SRS) are working efficiently but as isolated islands, leading to data and process redundancy.

In this paper, systems integrity has been based on Enterprise Resource Planning (ERP) which can definitely guarantee processes integrity from various departments. Systems integrity requires more work in order to be incorporated systematically into the everyday operations. Increased reflection and exchange are required on how to best re-design traditional regulatory education management system and control mechanisms so that they become more integrity sensitive. The rapid expansion in universities’ academic and management departments requires vast and flexible infrastructure solutions. Virtualization and cloud computing can assure such flexibility. Cloud computing can be defined as “means storing and accessing data and programs over the internet instead of your computer's hard drive. Cloud computing technology is a recent development, and allows users to share data, software and other resources across multiple computers on the Internet. This is cost effective and can save time, space, and licensing fees.

In this paper, we present an enhanced workflow to facilitate information access to students, academics and administrators. The basic idea behind enhancement will be based on the centralization and sharing feature of ERP.

\textbf{Keywords:} ERP, Integrated Education Management System, eLearning, Cloud Technology
Security Problems in Cloud Computing

Rola, MOTAWIE\textsuperscript{1}, Mahmoud, EL-KHOULY\textsuperscript{2}, M. Samir, ABOU EL-SEOUD\textsuperscript{3}\textsuperscript{*}

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Cloud is a pool of computing resources that are distributed among cloud users. Cloud computing has many benefits like scalability, flexibility, cost savings, reliability, maintenance and mobile accessibility. Since cloud computing technology is growing day by day, it comes with many security problems. Security of data in the cloud is one of the key challenges which acts as an obstacle to the implementation of cloud computing. There are new concepts that cloud introduces, such as resource sharing, multi-tenancy, and outsourcing, create new challenges for the security community. In this work, we provide a comparable study of cloud computing privacy and security concerns. We identify and classify known security threats, cloud vulnerabilities, and attacks.

Keywords: cloud computing, data privacy, threats, vulnerabilities
Malware Detection in Cloud Environment (MDCE)

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Since cloud computing technology is growing day by day, it comes with many security problems, especially from threats such as malware. As more services migrate to cloud architecture, the cloud will become a more appealing target for cyber criminals. In this paper, we present the current threats to cloud environment and summarizing the proposed detection systems for malware in the cloud. We then present a multiple detection system that is aimed at combating the spread of malware by cloud environment.

Keywords: Malware, Security, Cloud Environment
A Cloud-based Malware Detection Framework

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Malwares are increasing rapidly. The nature of distribution and effects of malwares attacking several applications requires a real-time response. Therefore, a high performance detection platform is required. In this paper, Hadoop is utilized to perform static binary search and detection for malwares and viruses in portable executable files deployed mainly on the cloud. The paper presents an approach used to map the portable executable files to Hadoop compatible files. The Boyer–Moore-Horspool Search algorithm is modified to benefit from the distribution of Hadoop. The performance of the proposed model is evaluated using a standard virus database and the system is found to outperform similar platforms.

**Keywords:** Cloud computing, Security issues, Malware, Static Binary Search, BMH, Hadoop
### Energy-ENER01- Green Process Engineering

**Session Chairs:** Mamdouh GADALLA & Hesham SAFWAT

**Tuesday November 8th - Time: 1:30 PM – 3:15 PM**

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<td>Proposed district cooling plant for the British University in Egypt campus</td>
<td>Mohamed HAMZA, Heba EL BOURINI, Ahmed ABDEL KARIM, Ahmed FAWZI &amp; Hesham SAFWAT</td>
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<td>Thermal Solar water heater prototype proposal for the British University Campus Bathrooms with energy measurement &amp; analysis VS. Traditional existing electrical water heater</td>
<td>Loai Sultan, Mohamed Hesham, George Jacoub, Mohamed Sharkawy &amp; Hesham Safwat</td>
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Potential Application of 15mo/sba-15 Photocatalyst for Removal of Multiple Organic Pollutants from Water Environment

Radwa A. Elsalamony*, Heba M. Gobara and Sherif A. Younis

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In this study, SBA-15 doped with 15%Mo as photo-stable catalyst were synthesized and then characterized by SBET, XRD, FTIR, HRTEM/EDX, and optical techniques. Herein, the photocatalytic performances were tested in the photo-degradation of three multi-organic mixtures composed of aromatic (i.e., benzene, naphthalene, anthracene and pyrene), phenolic (i.e. phenol, 2chlorophenol, 2,4-dichlorophenol and 2-hydroxybiphenyl) and dyes (i.e., methyl red and methyl orange). Photo-catalytic experiments were operated under three light sources including visible, UVA and UVC irradiation with a wavelength of 254 and 316 nm respectively and evaluated by HPLC-DAD analysis. The photo-catalytic activities of the 15Mo/SBA-15 were considerably greater under UVA irradiation than that of visible light irradiation and the photo-degradation rate was ranked in the order of aromatic > phenolic > dyes with rate of 95%, 69% and 14%, respectively. Light intensity and type of organic contaminants were key factors influencing the photo-catalytic degradation rate.

Keywords: Mo/SBA-15, Photo-catalytic degradation, UV irradiation, visible light, organic pollutants.
Proposed district cooling plant for the British University in Egypt campus

Mohamed HAMZA1, Heba EL BOURINI2, Ahmed ABDEL KARIM2, Ahmed FAWZI2, Hesham SAFWAT2*

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Egypt suffers from a major shortage in the produced electrical energy compared to local energy consumption. In order to solve the electricity crisis in Egypt, there must be alternatives to the traditional electric systems, which will reduce the electrical consumption significantly. One of those solutions is the district cooling concept.

District cooling plant is proposed to be constructed at the British University in Egypt to serve the main seven buildings of the university campus. The current cooling system installed in the campus is composing of DX splits and air handling units for all the university buildings, except for the main auditorium building which is supplied by chilled water from three reciprocating chillers. The current system cooling capacity is found to be \(1882.3 \text{ TR}\) which is resulted from combining the nominal value for each installed DX unit and for each chiller capacity.

However, the proposed district cooling plant shows great reduction in the cooling load required as proved from comprehensive calculations using the hourly analysis program (HAP) that the total coincident load of the proposed plant has found to be \(1284.6 \text{ TR}\).

The proposed primary cooling plant composes of three centrifugal chillers which is considered to be the most convenient chiller configuration for the university premises due to the variable cooling load, low part load and unavailability of natural gas pipelines needed for some other chillers type such as absorption chillers.

Full economical study is made for the proposed system by taking into consideration the primary cooling plant, chilled water circuits, pipes, ducts and energy transfer stations and it is found that the proposed system running cost per year is reduced by 41% compared to the current cooling system. Finally, energy optimization simulations are performed in order to define the most economic operating hours of the proposed system throughout the year.

Keywords: District cooling, running cost savings, optimum chillers configuration, energy optimization
Thermal Solar water heater prototype proposal for the British University Campus Bathrooms with energy measurement & analysis VS. Traditional existing electrical water heater

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For the past few years Egypt has been facing a crisis of electricity, which is expected to develop as a result of the increase in the population and temperature which will lead to an increase in the electricity consumption. In order to provide electricity and decrease the consumption of fossil fuels and electricity provided from the power plants, alternatives including solar energy must be considered.

One way to benefit from the solar radiation is to use it in water heating applications. It is proposed to switch all the electric heaters installed in the British University in Egypt bathrooms with solar thermal water heaters to decrease the electricity consumption of the campus.

After the completion of the campus there will be around 81 bathrooms located in 13 buildings. The installed traditional electric heaters can consume around 206,966 kWh in 6 month; instead, if the university implemented the solar thermal heaters, it would decrease the consumption to 41,391 kWh in the same period of time. Practical experiment is held inside the campus by installing one 300 liter solar thermal heater and comparing it with a traditional 30 liter electric heater.

The experiment will test the efficiency of the solar system and if it would be successful to replace the traditional electric heater. Fully detailed economical study will be done to show all the costs of installing the new solar systems and how it would save both energy and money.

Keywords: solar water heating, British university in Egypt solar heaters, energy saving, traditional electric heaters, solar heating benefits.
A New Graphical Technique for Efficient Energy

Design of Heat Recovery Systems in Chemical/Refining Industries

Dina KAMEL1*, Mamdouh GADALLA1, Fatma ASHOUR2

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Chemical processes are energy intensive industries; the majority of energy consumed in industrial processes is mainly used for heating and cooling requirements. This results in increasing the interest in obtaining the optimum design of the heat exchanger networks to reduce the energy consumption and face the growing energy crises.

Most of the published literature over the last fifty years promotes the process integration technology as a main part of the process system engineering science. Heat integration using Pinch Analysis is a systematic technique for identifying the heat recovery opportunities for heat exchangers in complex processes, and also for the design of thermally efficient systems by obtaining the targets of the process. The energy targets of the process were calculated graphically by the Composite Curves, or numerically by Problem Table Algorithm. Graphical Pinch Analysis method normally includes two key steps, firstly obtaining the energy targets which include the minimum energy required for the HEN design, then designing the heat exchanger network (HEN).

This paper introduces a new graphical approach for the design of new heat exchanger networks (HENs) based on pinch analysis rules. The HEN is represented on a simple graph, where the cold stream temperatures are plotted on the X-axis while the driving forces for each exchanger are plotted on the Y-axis. This graphical technique can describe the energy analysis problems in term of temperature driving force inside the heat exchanger, which is an important factor in the design process as the differences in these driving forces are involved in calculating the area of heat exchangers, and consequently affecting the cost. Each exchanger is represented in this graph as a straight line with a slope related to the heat capacity flows and length function of the heat duty. The graphical representation only requires very simple data that are readily available in every refinery site. Such data include temperatures of process streams, feed flows, and heat duties. The new graphical representation is simple to use and needs no simulation tools or software packages to perform design calculations and is found valuable for conceptual applications. The new graphical approach is applied for the design of the new heat exchanger networks for several objectives as the design with optimum area, optimum energy and optimum cost.

Keywords: Heat exchanger network, Energy saving, Grassroots design, Pinch analysis, Heat integration
Current Viscosity Measurements of Crude Oils over the Wide Ranges of Pressures and Temperatures

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In this study, current viscosity and density of two Egyptian crude oil samples from Amal and Qarun fields were measured at temperatures ranging from 20 °C to 100 °C. Consequently the results were used to develop graphs to determine the behavior of current viscosity at various conditions. For each sample, the current viscosity, current density and frequency were measure for the specified temperature range at 0, 5 and 10 bars for 200, 40 and 600 RPM. These resulted in a series of conclusions including that by increasing the pressure and temperature the current viscosity decreases. By increasing the frequency of the oil sample, the current viscosity decreased sharply and the highest current viscosity was detected at the highest pressure. Also the increase in pressure had no effect on the decreasing behavior of density with respect to increase in temperature. Finally, the increase in density leads to direct and clear increase in current viscosity.

\textit{Keywords:} Current viscosity, Experimental data, Density, Pressure, Crude Oil, Viscosity
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The Transformation of using Fractal Forms between Islamic and Digital Architecture Case study: King Abdullah Petroleum studies & research center, Riyadh, K.S.A

Amr Elgohary
The Higher Institute of Engineering, Sherouk, amr_elgo2000@yahoo.com

Along eras and civilizations, Nature always had a great role in inspiration of the Architectural form by the diversity of its vocabulary, roles, and colors...etc. Consequently Fractals as a main natural elements appeared in the Architectural morphology, since the ancient eras especially in the Islamic Architecture in a various levels of forms, details, and patterns. But nowadays the new Architectural theories dials with fractals concept in a different ways depending on the deep understanding of universal and cosmic nature, also the new digital techniques in Architectural design and construction that enhanced the appearance of new fractal forms. In this context the paper discusses the transformations of Fractal systems, Concepts and Applications in Architecture at the resent Architectural theories, focusing on the Digital Architecture and how it deals with fractal forms, aiming to root the new Architectural theories and link it with Islamic heritage to achieve a new Arab Architecture that respect and reveal the local heritage and adapt with the latest Architectural theories and techniques.

Keywords: Fractal Forms, Transformation, Morphology, Rhythm, Chaos Architectural Software, Digital Era.
Managing Heritage Crisis through Building Information Modeling Case Study: Museum of Islamic Arts in Cairo, after the Terrorism Attack 2014

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The paper will discuss using building information modeling as an efficient tool in managing the heritage crisis project, this tool used in revitalizing the museum of Islamic arts in Cairo after it had been attacked by terrorists.

In 24th of January 2014, The terrorism attacked the museum as the building just in front of Cairo Police security Center the target of the terrorism, but that caused a complete collapse of museum interior in addition to some objects totally lost from the weak material but the hard material from metal, marble, wood and stone survived, as a reaction of this crises many procedures taken to secure the collection under the debris a very sensitive processes of collapse layers removal were done, at that time another conservation and exhibition revitalization strongly needed to save both the historic building and the collection, in 2015 the United Arab Emirates funded a project for this revitalization and asked the Egyptian team for a complete management plan can timing and join it with the information of the project, so here where building information modeling used to this case as dealing with crisis project harder than ordinary management plans. This museum established by khedive Ismail, the idea of establishing a museum of Islamic arts showed up, as the number of objects increased and the space where they exhibited was very tight at el Hakem Mosque, a new building on that time constructed in Bab El Khalq area at Cairo, Egypt. The construction started 1899 and completed 1902 and named Arab antiquities house, after the collection increased from all over the world, here when the Arab term couldn’t suit the museum any more so it changed to be Museum of Islamic arts. The museum developed between 2002 and 2010 the conservation implemented to the building under Supreme Council of antiquities by Egyptians, while museum exhibition done by French designer.

A case study approach chosen as a strategy combining Experimental and simulation research, many variables experimented in many versions of design development which helped in design decisions as it was an opportunity to review the exhibition design to be more secured in order to take the suitable solution, in addition to simulate how the building and exhibition will be, by using Revit model in the early design stage then a complete Building Information Modeling on the level of fourth and fifth dimensions of BIM, the fourth is the time scheduling while the fifth is the cost estimates. Revitalizing the historic building and exhibition design of Islamic Arts museum in Cairo, Egypt after the crisis of terrorism attack by Building Information Modeling.

Keywords: BIM, Heritage Crisis, Islamic Museum, Management, Revitalization.
Simulate Egyptian cultural heritage using Augmented Reality Technologies Case Study: Pyramids and Giza Plateau cultural heritage site, Egypt

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The world witnessing a great technological progress in the field of computational systems, these systems allows many practical applications in heritage sites such as augmented reality (AR) technology, especially in the built heritage domain, where the user could augment the ancient physical world’s view with digital media. On other hand, there is an absence of using smart technological applications in marketing Egyptian cultural heritage to the audience, in order to enhance visitors experience into a high degree of realistic immersion, the augmented reality model usually include the use of Haptic interfaces. For the purpose of increasing users interaction with the site and give them the possibility to simulate ruins, buildings, landscapes or even ancient characters as they formerly existed and enhance their experience with sensory reactions, not just drop the virtual objects into the site.

The main objective of the research is to introduce the augmented reality technologies as an approach to present the Egyptian cultural heritage. The methodology starts with analyze examples of computational prototypes used the AR applications on cultural heritage which may help in framing guidelines to produce a computational model of augmented reality to simulate and visualize the case study as a result of the research.

Key words: Augmented Reality, Technology, smart, simulation, cultural heritage, Egyptian heritage.
Sustainable rehabilitation of cultural heritage landscape areas

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Cairo, one of the biggest cities in Egypt, encompasses with no doubt, a very rich collection of heritage buildings and wonderful historic green spaces. Yet, many of these heavily deteriorated architectural heritage as well as degraded open spaces need careful scenarios for sustainable interference and upgrading, taking into consideration environmental and socio-economic aspects. Therefore, it is considered challenging for practitioners and researchers to find an integrative approach to sustainable urban development especially due to its contextual peculiarity.

Green Rating Systems are considered recent tools to promote sustainable urban development. They offer guidelines and measurement criteria that may help practitioners and researchers draw up sustainable urban development plans and find means to assess the sustainability of such plans. Yet, their use is still a wide open field of study in order to highlight its potentials on one hand and its gaps and limitations on the other hand to support an enlightened decision making process. This study revealed that existing green rating systems do not consider cultural heritage landscape areas like Giza zoo which requires consideration for its socio cultural, economic and environmental roles. Each of them should be properly assessed and incorporated equally to achieve Sustainable rehabilitation scenarios for these degraded valuable areas. Hence, this study presents means of contextualizing and integrating such tools together in order to develop multi-criteria assessment method and a set of indicators tailored for cultural heritage landscape areas that may be the core for drawing up Egypt’s own criteria of sustainable urban development.

Keywords: Decision making support tool, Sustainable development, Cultural heritage landscapes, LEED ND, SITES initiative, Giza zoo, sustainable rehabilitation.
Framework HBIM Applications in Egyptian Heritage

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Building Information Modelling (BIM) radically changed the design and documentation processes in AEC industries. BIM coupled with 3D laser scanning (LIDAR) technologies revolutionized the built environment documentation methods. Many efforts were directed toward utilizing these technologies in the documentation and restoration of heritage buildings, adopting Heritage Building Information Modelling (HBIM). This paper presents a framework for HBIM application in Egyptian Heritage. The framework considers 3D laser scanning to document heritage buildings. A new approach of utilizing processed and segmented point clouds as a standalone is proposed for heritage information to be utilized as a platform which suffice a range of stakeholders needs. The proposed platform is developed using AutoCAD Add-on that adds and retrieves information in computer readable formats directly from segments of the processed point cloud. The proposed approach is capable to utilize processed point clouds to create different purpose BIM models with different level of details to suite different heritage documentation needs. A case study is presented to illustrate the practical aspects of proposed framework.

Keywords: Egyptian Heritage, electronic documentation, laser scanning, HBIM.
## Emerging Technologies in Informatics-ETI02- Artificial Intelligence Techniques & Applications

**Session Chair:** Walid HUSSEIN

**Tuesday November 8th - Time: 3:30 PM – 5:15 PM**

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Data Mining Techniques for Credit Card Fraud Detection: Empirical Study

Marwan Fahmi, Abeer Hamdy, Khaled Nagati

British University in Egypt, Faculty of Informatics and Computer Science

Fraud detection is a crucial problem that has been facing the e-commerce industry for decades. Financial institutions throughout the world lose billions due to credit card fraud, which necessitate the use of credit card fraud prevention. Several models have been proposed in the literature, however, the accuracy of the model is crucial. In this paper four fraud detection models based on data mining techniques (Support vector machine, K-nearest neighbours, Decision Trees, Naïve Bayes) were developed and their performances were compared when applied on a real life anonymised data set of transactions (“UCSD-FICO Data Mining Contest 2009”). Four relevant metrics were used in evaluating the performance of the classifiers which are True positive rate (TPR), False Positive Rate (FPR), Balanced Classification Rate (BCR) and Matthews Correlation Coefficient (MCC).

Keywords: Fraud detection, SVM, K-NN, Naïve Bayes, Decision Tree
Cairo Public Transport Route Finder Pilot System

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Aiming to facilitate selection of transport links leading from a starting location to destination in greater Cairo, we propose in this work a public transportation mobile (android) application to assist users of public transport. The system is a pilot application that considers the public mini-bus network in three areas of Cairo, and builds the database of the mini-bus network verified on the ground, from which the graph of transportation network constituting of nodes and possible links between them is constructed. The system then identifies the suitable series of public transports possible, calculates the shortest path between the two chosen locations, and displays the buses and their route to the user, ordered by distance. The two specialized algorithms: Dijkstra (Shortest Path Algorithm) and A-Star algorithm are implemented and compared on the database of routes available. Comparison of the implemented algorithms for performance is presented as well as a discussion on the way forward to fully automate the public transport route selection inside Cairo.

Keywords: shortest path search, public transport networks, route selection.
On Bubble Sizing in Water by Ultrasound

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Classifying bubbles in liquids is a crucial problem that is demanded within multiple fields. This paper discusses a new method for classifying bubble sizes in non-contact and inexpensive approach using ultrasound analysis. Exploiting the principle of buoyancy, free rising bubbles with larger volumes elevate faster to the surface compared to the smaller ones, given that they have the same densities. An envelope detector is proposed which tracks the changes in the ultrasound signals reflected by the bubbles when they cross the ultrasound field. These changes in the reflected signals are distinctive for the sizes under consideration. Relevant spectral and linear predictive coding features that represent the distinct characteristics are extracted. These features are fed to a feed-forward artificial neural network to successfully classify air bubbles according to their sizes with an accuracy of 98.8%. This method provides promising applications to be implemented in industrial, biomedical and environmental fields.

Keywords: Ultrasound analysis, bubble size classification, signal processing, feature extraction, artificial neural network
A quantitative analysis for the correlation between corporate financial and social performance

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Recently, the corporate social performance (CSP) is not less important than the corporate financial performance (CFP). Debate still exists about the nature of the relationship between the CSP and CFP, whether it is a positive, negative or a neutral correlation. The objective of this study is to explore the relationship between corporate social responsibility (CSR) reports and CFP. The study uses the accounting-based and market-based quantitative measures to quantify the financial performance of seven organizations listed on the Egyptian Stock Exchange in 2007-2014. Then uses the information retrieval technologies to quantify the contribution of each of the three dimensions of the corporate social responsibility report (environmental, social and economic). Finally, the correlation between these two sets of variables is viewed together in a model to detect the correlations between them. This model is applied on seven firms that generate social responsibility reports. The results show a positive correlation between the Earnings per share (market-based measure) and the economical dimension in the CSR report. On the other hand, total assets and property, plant and equipment (accounting-based measure) are positively correlated to the environmental and social dimensions of the CSR reports. While there is not any significant relationship between ROA, ROE, Operating income and corporate social responsibility. This study contributes to the literature by providing more clarification of the relationship between CFP and the isolated CSR activities in a developing country.

Keywords: Financial performance, Social performance, Machine learning
Big Data and Cloud Computing: Trends and Challenges

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Big data is currently one of the most critical emerging technologies. Big Data are used as a concept that refers to the inability of traditional data architectures to efficiently handle the new data sets. The 4V’s of big data – volume, velocity, variety and veracity makes the data management and analytics challenging for the traditional data warehouses. It is important to think of big data and analytics together. Big data is the term used to describe the recent explosion of different types of data from disparate sources. Analytics is about examining data to derive interesting and relevant trends and patterns, which can be used to inform decisions, optimize processes, and even drive new business models. Cloud computing seems to be a perfect vehicle for hosting big data workloads. However, working on big data in the cloud brings its own challenge of reconciling two contradictory design principles. Cloud computing is based on the concepts of consolidation and resource pooling, but big data systems (such as Hadoop) are built on the shared nothing principle, where each node is independent and self-sufficient. The integrating big data with cloud computing technologies, businesses and education institutes can have a better direction to the future. The capability to store large amounts of data in different forms and process it all at very large speeds will result in data that can guide businesses and education institutes in developing fast. Nevertheless, there is a large concern regarding privacy and security issues when moving to the cloud which is the main cause as to why businesses and educational institutes will not move to the cloud. This paper introduces the characteristics, trends and challenges of big data. In addition to that, it investigates the benefits and the risks that may rise out of the integration between big data and cloud computing.

Keywords: Big data, cloud computing, Analytics.
**Electro-Mechanical Technologies-AMT02-Health Monitoring**

Session Chair: *David Mba*

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*Adebayo OGUNDARE, Sunday OJOLO, David MBA & Fang DUAN* |
| 2 | 3:50 – 4:10   | Vibration synchronous response of a centrifugal compressor due to unbalance and excessive seal clearance – Case study  
*Mohamed Al Yahyai, Fang Duan & David Mba* |
| 3 | 4:10 – 4:30   | Energy-Aware Optical and Photonic Networks-on-Chip for High-Performance Computing Systems  
*Ahmed Mahany, Samy Ghoniemy, & Hossam Faheem* |
| 4 | 4:30 – 4:50   | Using Empirical Mode Decomposition Scheme for Helicopter Main Gearbox Bearing Defect Identification  
*Fang DUAN & David MBA* |
| 5 | 4:50 – 5:10   | Helicopter Gearbox Bearing Fault Detection using Kurtogram and Envelope Analysis  
*Linghao ZHOU Fang DUAN, Matthew GREAVRS, Faris ELASHA, Suresh SAMPATH & David MBA* |
Review of fault detection techniques for health monitoring of helicopter gearbox

Adebayo OGUNDARE\textsuperscript{a}, Sunday OJOLE\textsuperscript{a}, David MBA\textsuperscript{b}, Fang DUAN\textsuperscript{b}

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In most cases the helicopter transmission system comprises of the main gearbox (MGB), auxiliary gearbox (AGB), intermediate gearbox (IGB) and tail rotor gearbox (TGB). A local gear fault will impose a force variation in the gearbox and changes the gear angular velocity resulting in frequency modulations, which in turn generates sidebands and changes the vibration signature. The change in vibration signature contains information about the health of the gearbox from which diagnosis can be made to prevent the catastrophic effect of propagated fault. The helicopter gearbox vibration mode differs from those of other systems due to the transmission noise, structural noise and aero acoustic noise which masks the sideband. Thus an attempt is made to review the condition indicators that have been applied for fault diagnosis on the helicopter gearbox. This review is intended to advance the knowledge and the performance of Health and Usage Monitoring System in the helicopter transmission system.

\textbf{Keywords:} Helicopter; transmission; gearbox; vibration; fault detection; condition indicators; health monitoring
Vibration synchronous response of a centrifugal compressor due to unbalance and excessive seal clearance – Case study

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The back to back, two stage, nine-impeller gas centrifugal compressor is usually used to compress natural gas associated with oil production in a particular field within the Sultanate of Oman. The highly pressurised natural gas is injected into the oil reservoir to enhance and maintain the oil flow as well as compensate for any pressure depletion in the wells. Thus, the effective and safe operation of compressor is critical to ensure continuous productivity. This paper presents a case study on the effect of fouling and worn long-span labyrinth seals on the rotor dynamics of a high-speed gas centrifugal compressor. Furthermore, vibration problems of an operational gas compressor were replicated on a rotor-dynamic model so as to understand the root cause and investigate the influence of seal wear and hydrocarbon fouling on the compressor synchronous vibration. In addition, the paper demonstrates the dominant influence of inlet stages on rotor vibration in the presence of fouling.

Keywords: Condition monitoring; gas compressor; rotor-dynamics; fouling; seal wear; vibration
Energy-Aware Optical and Photonic Networks-on-Chip for High-Performance Computing Systems
Ahmed Mahany, Samy Ghoniemy, and Hossam Faheem

Based on the current technology trends, Heterogeneous HPC systems of 1000 cores or more are highly promising. However, their promise of increased Tera-Scale computing performance will only be realized if their power consumption, internal communication and routing challenges are overcome. One of these systems that is currently commercially available is the IBM Blue Gene/Q. Fortunately, recent advances in the manufacturing of nano-photonic device, optical network on chip together with the optical interconnect technology and optical routing can enable these systems to efficiently perform a Tera-Scale computing.

In this paper, an optical Network-on-Chip (ONoC) together with a Photonic Network-on-Chip (PNoC) are proposed to replace the conventional electrical Networks-on-Chip (NoC) of the Heterogeneous HPC systems and will be deployed on the IBM Blue Gene/Q compute chip as a case study. The proposed ONoC and PNoC are intended to overcome the performance limitations of Heterogeneous HPC systems and provide significant low latency, high bandwidth and low power dissipation. A 2D mesh-based optical network on chip (ONoC) together with the photonic network on chip (PNoC) architecture for optical routing and switching are modeled and developed using an open source customized PhoenixSim network simulator. The proposed models are based on recent advancement in nano-photonic device fabrication community, architecture design community and CAD optimization community and includes on-chip optical light sources and modulators, photo detectors, buffers, switches, couplers, optical waveguides and on-chip WDM devices.

Through a series of simulations, we studied the efficiency of the proposed system, its power and energy consumption, data transmission latency and throughput. Moreover, the design parameters of a commercial IBM Blue Gene/Q computer chip is used to compare the overall system performance using its current conventional architecture with using the proposed ONoC and PNoC architecture under various traffic patterns and traffic loads.

Averaged across different traffic patterns and loads, the proposed architectures reduces the overall energy consumption by approximately 40% compared to electronic one, and achieves an average decrease in end-to-end delay of approximately 60% compared with the commercial system, meanwhile it remarkably exceeds the offered throughput of the current commercial system.

The results also show the performance superiority of the proposed ONoC the electronic NoC.

Keywords: NoC; photonic NoC; energy-aware; high-performance
Using Empirical Mode Decomposition Scheme for Helicopter Main Gearbox Bearing Defect Identification

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Vibration sensors for helicopter health and condition monitoring have been widely employed to ensure the safe operation. Through the years, vibration sensors are now commonplace on helicopters and have claimed a number of successes in preventing accidents. However, vibration-based bearing defect identification remains a challenge since bearing defects signatures are usually contaminated by background noise resulting from variable transmission paths from the bearing to the receiving externally mounted vibration sensors. In this paper, the empirical mode decomposition (EMD) scheme was utilized to analyze vibration signal captured from a CS29 Category ‘A’ helicopter main gearbox, where bearing faults were seeded on one of the planetary gears bearing of the second epicyclic stage. The EMD decomposed vibration signal into a number of intrinsic mode functions (IMFs) for subsequent envelope analysis. The selection of appropriate IMFs to characterize bearing fault signatures was discussed. The analysis result shows that the bearing fault signatures were successfully characterized and revealed the efficacy of the EMD scheme. The detailed experimental rig and fault signature characterization will be provided in the full paper.

Keywords: MGB, bearing fault diagnosis, condition monitoring, EMD
Helicopter Gearbox Bearing Fault Detection using Kurtogram and Envelope Analysis

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The main gearbox (MGB) is a crucial part of a helicopter. It is responsible for converting high input speed with low torque from engines to lower speed with high torque in order to drive rotor and other accessory systems. MGB bearings suffer intensively from stress and friction during flights, hence concerns for their health condition and detecting potential defects become critical for the sake of operation safety and system reliability. In this study, bearing defects were seeded in the second epicyclic stage bearing of a commercial Class A helicopter MGB. Vibration and tachometer signals were recorded simultaneously for the purpose of fault diagnosis. The tests were carried out at different power and speed conditions for various seeded bearing defects. This paper presents a comparison of signal processing techniques employed to identify the presence of the defects masked by strong background noise that generated from an operation helicopter MGB.

Keywords: MGB, Bearing Fault Diagnosis, Kurtogram, Envelope Analysis
Energy-ENER02- Solar Energy
Session Chairs: Hamdy AL-GHITANY & Iman EL-MAHALAWI

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Solar Panels as an Efficient Energy Saving Tool in New Housing

Districts in Cairo

Karim KESSEIBA1

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Amid the horizontal expansion in new cities designed in Cairo suburbs, the dilemma of energy efficiency is re-questioned, especially in the shadows of challenges of global warming and the limited non-renewable resources available. Thus, the paper examines the use of solar panels positioned on roof tops of houses, precisely in new developments where horizontal expansions of houses provide more roof tops to apply the solar panels for a fewer number of users, accordingly provide better ratio of energy consumption in relation to production via the solar panels.

The methodology followed in the paper depends on the analysis of the capacity of energy produced by the solar panels in relation to energy consumed by users of a single house in one of the new developments. This analysis highlights the amount of non-renewable energy saving acquired by using more environmental friendly methods of energy production. Following that a comparative analysis is highlighted between the extended applications of this system of energy production on a whole neighborhood to examine the economics of energy saving in case of application on large scale projects. The paper concludes by a set of recommendations for improving the methods of applying renewable energy production techniques in new cities.

Keywords: Solar Panels, Energy Efficiency, Horizontal Urban Expansion, New Cities in Cairo.
Development of efficient nanoparticle-based catalysts for the direct ethylene glycol fuel cell

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An enhanced electrocatalytic activity towards ethylene glycol oxidation reaction (EGOR) in alkaline medium is observed at a glassy carbon (GC) electrode modified with a nanoparticle-based binary catalyst composed of Pt (nano-Pt) and cobalt oxide (nano-CoOx). The electrocatalytic activity of the modified electrodes towards EGOR depends on the loading level as well as the composition of the catalyst layer atop the GC electrode surface. Several techniques including cyclic voltammetry (CV), field-emission scanning electron microscopy (FE-SEM) and energy dispersive X-ray spectroscopy (EDS) are used to address the catalytic activity of the proposed catalyst and to reveal their surface morphology and composition, respectively. CV measurements showed that the CoOx/Pt/GC electrode (with nano-Pt; furnished at the base and nano-CoOx; the topmost layer) support the largest increase in the oxidation peak current (Ip) of EGOR, that is, Ip is two times larger than that obtained at Pt/GC electrode, concurrently with a significant negative shift in the onset potential (Eonset) of EGOR by $\Delta$170mV. Moreover, this electrode showed a significant stability over a prolonged time of continuous electrolysis.

\textbf{Keywords}: Direct alcohol fuel cell; Electrocatalysis; Platinum nanoparticles; Transition metal oxides.
Modeling Various Solar Cells Materials Using Lorentzian-Drude Coefficients

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In order to develop an optoelectronic model for simulating different light trapping structures sandwiching the photovoltaic active layer, determining the materials dispersion and absorption properties is a must. The targeted model should be able to simulate the desperation and absorption capabilities of different conductor and semiconductor materials over the entire sun spectrum (200 nm to 1700 nm). Therefore, the Lorentzian-Dude (LD) model is chosen due to its simplicity in implementation with the finite difference time domain algorithm chosen for optical modeling. In this paper, various materials are selected to be modeled with the LD model. In addition to that, a novel approach in modeling materials is presented based on portioning the spectrum into sub bands and fitting these bands individually with enabling the multi-processing mechanism. The proposed algorithm is not only used for modeling material behavior of various conducting materials published in literature, but is also used for other conducting and semiconducting materials that the original model was not capable of modeling over the entire range of spectrum. Besides that, the suggested algorithm showed a better time performance than those mentioned in literature. Experimental prototype samples were made to validate the simulation results, showing perfect agreement.

Keywords: Solar Cells materials, Dispersion, Absorption, Optoelectronic Modeling, Finite element method.
# Structures, Built and Natural Environment -SBNE03- Smart Heritage-2

**Session Chairs:** Gehan NAGY & John COUNSELL

**Wednesday November 9th - Time: 1:30 PM – 2:50 PM**

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<td>Hala ASSEM &amp; Marwa ELSAYED</td>
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<td>Rationality versus Functionality Steel as a New Building Material by the Turn of the Nineteenth Century The Battle of the Styles</td>
<td>Hazem ELDALY &amp; Rasha ABDELLATIF</td>
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<td>Renovating the Mohamed Ali’s Grand Masjid district at Zagazig city as Sustainable Development</td>
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The Role of Technology in investigating the Effects of Cultural Events on Streets

Hala ASSEM1, Marwa ELSAYED2*

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Urban Spaces and culture have mutual influences, “When public spaces are successful [...] they will increase opportunities to participate in communal activity”(Carr et al., 1993). The city of Cairo has an enormous number of livable streets that accommodate cultural events; however, many of such streets lack the design principles that sustain and enhance the occurrence of those events. Trials to investigate and update the different possibilities for redesigning cultural urban spaces have different approaches. One of those new approaches is Geographic Information System (GIS) which facilitates creating the needed database for cultural heritage sites. The paper aims to investigate the mutual relationship between cultural events and street design, through determining the physical elements of street design that enhance its functions, promote cultural events and bring its benefits, with the help of GIS tool.

The research follows an observational method approach to reach design guidelines that will enhance the street to accommodate cultural events. This will be done through a criteria developed by the researcher that will be imported to the GIS to get results using queries through the comparative analysis between the international standards and the current situation for the targeted case study of Al – Azhar Street, which is considered one of the main urban spaces in Cairo that witnesses many cultural events throughout the year, while the design of the street doesn’t help in smoothly managing such events. Finally, the research will conclude how the cultural events could affect the street design and propose redesign alternatives to promote cultural events in the street.

Keywords: Digital Technology, GIS, Street Design, Cultural Events, Cultural Heritage Sites.
Rationality versus Functionality Steel as a New Building Material by the Turn of the Nineteenth Century The Battle of the Styles

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By the simplest definition, architecture is the design of buildings, executed by architects and built by engineers. However, it is more. It is the expression of thought in building not simply construction, the piling of stones or the spanning of spaces with steel girders. It is the intelligent creation of forms and spaces that in themselves express an idea. Construction becomes intelligent and thus architectural when it is efficient and immediately appears so. If it is the simplest and most advanced type of structure, solving the task set for it, and conceivable in its age, construction will have the quality of perfect appropriateness and will also be the expression of the mechanical knowledge of a culture. It becomes intelligent also when it is made to emphasize its simplicity and to express its system of support so that both can be immediately understood.

In western world 19th-century architecture was greatly influenced by earlier architectural movements and foreign, exotic styles, which were adapted to the new technologies of the early modern age. The revivals of Greek, Gothic, and Renaissance designs were fused with contemporary engineering methods and materials. Historicism idealized past empires and cultures, and used motifs inspired by them to stimulate national nostalgia.

With the two principal characteristics distinguish 19th-century architecture; the use of a variety of historical styles and the development of new materials and structural methods, this paper will present the dialectical approach to two schools of thought in architecture. These schools lie on the two opposite sides of the Atlantic Ocean: Europe and the United States of America. In both, architectural thought was included in a broad body of discourse that existed in both societies and trends towards using Steel as a new building in their architecture. In both schools architectural products were mainly related to a main body of cultural and philosophical thoughts and inclinations.

Keywords: steel, glass, ornaments, functionality, rationality, Neoclassicism, Modernism.
Sustainable Development of Heritage Areas: Towards Cyber-Physical Systems Integration in Extant Heritage Buildings and Planning Conservation

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Architectural heritage reflects the evolution of human civilization throughout history, whereas civilized and social changes of heritage areas in many countries led to degradation. There are many interpretations in the development of heritage buildings and planning; however, there is deterioration those areas as a result of non-sustainable development and non-specified ranges for the framework development planning.

Historical building and planning conservation raises two important issues: the restoration and improvement of historical areas features and adopting a framework of sustainable development in heritage regions. Conceptually, HBIM (Historic Building Information Modelling), a plug-in for Building information modelling (BIM), was introduced as a process for modelling historic structures from laser scan and photogrammetric data. Thus HBIM is specially tailored to the application on heritage buildings and on the long-term management of the built environment. However, employing the "cyber-physical systems" approach achieves more potential by integrating virtual models and physical construction, enabling bidirectional coordination. This will serve as a digital archive to help in conserving the heritage buildings and to test future development proposals within the context of these historic buildings. The present study contributes to the body of knowledge by proposing a cyber-physical systems (CPS) approach to innovatively integrate Heritage building information modelling (HBIM) and physical construction. The aim of this paper is to develop an approach representing a role model for the development of heritage buildings and planning by applying an adaptive cyber-physical system through a framework of sustainable development in heritage regions. The paper presents a review of the BIM use in the field of cultural heritage, reporting the existing BIM/HBIM platforms and analyzing cyber-physical systems integration in extant heritage buildings and planning conservation. Results of this paper are implementation and analysis of an integrated framework for cultural heritage applying an adaptive cyber-physical system for heritage building and planning conservation.

Keywords: Heritage Buildings, Management of built environment Cyber-Physical Systems HBIM, Sustainable Development
Renovating the Mohamed Ali’s Grand Masjid district at Zagazig city as Sustainable Development

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Zagazig city is the capital of Sharkia government; it is one of most important historic cities, as it have both ancient Egyptian and Islamic monuments. One of the most important monuments it have is the Grand Masjid (mosque) in kitharia district, which Mohamed Ali erected it especially for builders who came for building nine aqueducts on Mois River.

This study aims to study this remarkable monument and its surrounding area to renovating it and have a sustainable development, this study is divided into two section the first one investigate the current conditions of district to show its problems, the second section focuses on setting new sustainable development plan for the surrounding area inspired by the original style of both the Grand masjid and the Nine Aqueducts, restore its original character and preserve its social and economic activities.

Keywords: Mohamed Ali Grand Masjid (mosque)-the Nine Aqueducts –Islamic monuments in Zagazig- sustainability.
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<td>Utilizing DNA Strands for Secured Data-Hiding with High Capacity</td>
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<td>Samir ABOU EL-SEOUD, Reham MOHAMED, Samy GHONAMY &amp; Walid HUSSEIN</td>
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<td>A MapReduce Framework for DNA Sequencing Data Processing</td>
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<td>Investigation in customer value segmentation quality under different preprocessing types of RFM attributes</td>
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Utilizing Nested Normal Form to Design Redundancy Free JSON Schemes

Wai Yin Mok*

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JSON (JavaScript Object Notation), based on the JavaScript programming language, is a lightweight data-interchange format for the Internet. JSON is built on two structures: (1) A collection of name/value pairs. In various languages, this is realized as an object, record, struct, dictionary, hash table, keyed list, or associative array. (2) An ordered list of values. In most languages, this is realized as an array, vector, list, or sequence (http://www.json.org/). Similar to XML, JSON schemes allow nested structures to model hierarchical data to be transferred over the Internet. As collaboration over the Internet increases exponentially due to cloud computing or otherwise, redundancy free JSON data are an attractive form of communication. Nested Normal Form, a normal form for hierarchical databases, is a precise characterization of redundancy in hierarchical data. A nested table, or a hierarchical scheme, is in Nested Normal Form if and only if it is free of redundancy caused by multi-valued and functional dependencies. Using Nested Normal Form as a guide, this paper introduces a JSON scheme design methodology that begins with a UML class diagram that models an application at hand. A UML class diagram naturally generates a set of multi-valued and functional dependencies as constraints for the application. The methodology selects a class as the root of a JSON scheme and repeatedly adds classes from the class diagram to the scheme as long as the scheme satisfies Nested Normal Form. This process continues until all of the classes in the class diagram have been added to some JSON schemes. Generating JSON schemes in Nested Normal Form have the benefit that they are free of redundancy with respect to the generated multi-valued and functional dependencies, and thus they are free of insert, delete, and update anomalies.

Keywords: JSON, Nested Normal Form, Redundancy Free JSON Schemes
Utilizing DNA Strands for Secured Data-Hiding with High Capacity

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Nowadays, the improvement of network technologies raises the demand for data-safe transmission. Therefore, the need to come up with new techniques for securing data and accommodating the growing quantities of information is crucial. From nature to science, the idea that genes themselves are made of information stimulated the research in molecular deoxyribonucleic acid (DNA). One of the promising usages of the DNA molecule is DNA steganography, where DNA is used as an information carrier to achieve high data storage capacity as well as high security level. Currently, DNA steganography techniques utilize the properties of only one DNA strand, and keep the second one unutilized. This paper presents a steganography technique that hides data into both DNA strands, and thus doubles the capacity of data stored. In the proposed technique, the key has the same length of the reference DNA sequence. The sender sends both the encrypted DNA message and its reference DNA sequence together into a microdot. If the recipient receives this microdot uncontaminated, the sender can safely send the key afterwards. The proposed technique guarantees a secure transmission process as well, for even if the attacker suspects the fakery of the first-sent DNA sequence, they will never receive the key, and hence full data extraction is nearly impossible. The conducted experimental study confirms the effectiveness of the proposed technique.

Keywords: DNA, Data hiding, DNA steganography, Hiding Capacity.
DNA Computing: Challenges and Applications

Samir ABOU EL-SEOUD\textsuperscript{1}, *Reham MOHAMED\textsuperscript{2}, Samy GHONAMY\textsuperscript{3}, Walid HUSSEIN\textsuperscript{4}

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Much of our scientific, technological, and economic future depends on the availability of an ever increasing supply of computational power. However, the increasing demand for such power has pushed electronic technology to the limit of physical feasibility and has raised the concern that this technology may not be able to sustain our growth in the near future. It became important to consider an alternative means of achieving computational power. In this regard, DNA computing was introduced based on the usage of DNA and molecular biology hardware instead of the typical silicon based technology. The molecular computers could take advantage of DNA's physical properties to store information and perform calculations. These include extremely dense information storage, enormous parallelism and extraordinary energy efficiency. One of the main advantages that DNA computations would add to computation is its self-parallel processing while most of the electronic computers now use linear processing.

In this paper, the DNA computation is reviewed and its state of the art challenges and applications are presented. Some of these applications are those require fast processing, at which DNA computers would be able to solve the hardest problems faster than the traditional ones. For example, 10 trillion DNA molecules can fit in one cubic centimeter that would result in a computer that holds 10 terabytes of data. Moreover, this work focuses on whether a large scale molecular computer can be built.

Keywords: DNA Computer, Biocomputer, Quantum Computation, Molecular Computation.
A MapReduce Framework for DNA Sequencing Data Processing

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Our focus in this paper will be implementing DNA sequencing as a set of MapReduce programs that will accept a DNA data set as a FASTQ file and finally generate a VCF (variant call format) file, which has variants for a given DNA data set.

Keywords: DNA and RNA sequencing, FASTQ, MapReduce, TemplateEngine, Recalibration.
Investigation in customer value segmentation quality under different preprocessing types of RFM attributes

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Customer value segmentation helps retailers to understand different types of customers, develops long term relationship with them, and hence increases their value and loyalty. This study aims to evaluate the quality of customer value segmentation based on two methods of preprocessing the RFM attributes.

K-means clustering algorithm is used for the customer value segmentation based on the scored RFM and the actual value of RFM. The quality of the clustering results is tested using the Sum of Squared Error (SSE). Results obtained show that using the actual value of RFM in customer segmentation reduces the clustering error (SSE) and enhances the accuracy of segmentation than using the scored RFM.

Keywords: Customer Relationship Management (CRM); Customer Value (CV); RFM Model (Recency, Frequency, Monetary); Actual RFM; Scored RFM; K-means algorithm; Sum of Squared Error (SSE).
### Structures, Built and Natural Environment - SBNE04- Water Desalination

**Session Chairs:** Sherif KANDIL & Amr ABDELKADER

**Wednesday November 9th - Time: 1:30 PM – 3:15 PM**

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<td>Ooids as New Filtration Media for Seawater Desalination Plants</td>
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<td>Influence of the salt properties on their transport through thin film reverse osmosis membranes</td>
<td>Thin Film Composite Membranes Incorporated with Graphene Oxide nanosheets; Preparation and Performance in Water Desalination</td>
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<td><em>Ali Mohamed Elsayed Abdelfattah</em></td>
<td><em>Dalia E. Abo Zaid</em></td>
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Ooids as New Filtration Media for Seawater Desalination Plants

A.A. BAKR¹*, and W.A. MAKLED²

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Naturally, ooids were obtained by sieving from an open-intake in the Mediterranean Sea in Marsa Matrouh city in Egypt and other coasts and they are varying in its size from less than 0.1 up to 0.8mm compared to conventional sand-media of seawater desalination plants as a new pretreatment media-filtration. Ooids media-filtration system demonstrated a performance in removing particulates from the feed water and producing permeate of acceptable quality for feeding the RO membranes at different temperatures 20, 30 and 40°C and different flow rates 20, 40 and 60l/min. At lower flow rate 20l/min and higher 40°C, the ooids grains-filter produced water with better quality compared to that obtained from the sand-filter. The silt density index (SDI), turbidity and total organic carbon (TOC) are the filtrate quality parameters relevant to feeding desalination plants. The addition of coagulant at a concentration 1.6mg Al/l of poly-aluminum chloride (PAC), produced a filtrate from ooids filter of better SDI (less than 3), lower turbidity (0.21 NTU) and higher TOC% reduction (66.1%). This study is based on a semi-pilot desalination unit, which located in the Egyptian Petroleum Research Institute (EPRI).

Keywords: Desalination, Reverse osmosis, Seawater, Ooids, Water treatment
Performance enhancement of TFC RO membrane by using magnesium silicate nano-particles

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In this study, MgSiO2 nano-particles were effectively attached to the surface of polyamide (PA) thin-film composite (TFC) membrane via bonding with (2-acylamido 2-methyl propane sulphonic acid) (AMPS) as abridging monomer. Water flux and salt rejection of the resulting membrane were compared with, (AMPS) monomer grafted membrane and the pristine TFC membrane through permeation experiment with brackish water at a constant trans-membrane pressure of 25 bar, the water flux resulted as 25 L/m²h while, salt rejection was 95.5%.

Scanning electron microscope (SEM), Fourier transform infrared (FT-IR) and X-ray diffraction (XRD) were utilized to confirm the existence of MgSiO2 nano-particles and to examine the morphology of the TFNC membrane. The results showed the AMPS is successfully grafted on the TFCRO membrane surface. Also, Thermo Gravimetric Analysis (TGA) and Dynamic Mechanical analysis (DMA) had proven the improvement of thermal and mechanical proprieties of the resulted TFNC membrane compared to TFC membrane. Additionally, TFNC membrane water contact angle was about 45.9°, shows a relatively hydrophilic surface. The results successfully demonstrated that MgSiO2 could be grafted onto TFC via chemical bonding, leading towards the development of an advanced functional TFCRO membrane with enhanced properties.

Keywords: Membrane performance, Reverse osmosis, Water desalination, Thin film composite, Magnesium silicate nano-particle.
Influence of the salt properties on their transport through thin film reverse osmosis membranes

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³Research Assistant, Hydro-geochemistry department, Egypt Desalination Research Center of excellence (EDRC), Desert Research Center, Cairo, Egypt.

Salt properties such as ionic size, diffusivity and concentration are three important parameters used to indicate the flow behavior of the salt through thin film composite (TFC) reverse osmosis (RO) membranes. In our study, NaCl, Na2SO4, CaCl2.2H2O, MgSO4.7H2O salt was used as feed solutions. Four concentrations were prepared (1000, 2000, 5000, 10000 ppm) for each salt and each salt concentration was operated at two and three folds of its osmotic pressure. All experimental conditions were done on the flat sheet thin film membrane model YMSGSP4205 using CF042 cross-flow test cell to determine the membrane performance, membrane transport parameters and the factors affecting these salts transport. The observed salt rejection and volumetric water flux were calculated and the graphical method was applied to determine the mass transfer coefficient to study the effect of salt properties on these results. The results indicated that the salt rejection percentage are in the order of Na2SO4> NaCl> MgSO4.7H2O > CaCl2.2H2O with values of 97.9%, 97%, 93% and 92%, respectively, at 2000ppm.

Keywords: Reverse Osmosis, Thin Film Flat membranes, ionic size, diffusivity, Salt Transport, graphical method.
Thin Film Composite Membranes Incorporated with Graphene Oxide nanosheets; Preparation and Performance in Water Desalination

Ali Mohamed Elsayed Abdelfattah
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This work deals with thin film composite membranes prepared from m-phenylenediamine and 1,3,5-benzenetricarbonyl chloride by interfacial polymerization on the surface of a polysulfone substrate, and graphene oxide was embedded into the membrane during membrane formation to improve the membrane performance. The desalination performance of the membranes was evaluated in terms of water flux and salt rejection, along with a baseline membrane containing no graphene oxide. The membrane morphology and surface properties were also studied using contact angle measurements, FT-IR, XRD and SEM. Incorporating a small amount of graphene oxide into the membrane was shown to improve the water flux, mechanical stability, and chlorine and fouling resistances of the membrane. At 15 bar, a water flux of 29.6 L/m²·h and a salt rejection of ≥97% were obtained for a saline solution (2000 ppm of NaCl) when the amine reactant contained 100 ppm of graphene oxide during membrane fabrication. The membranes were found to be stable in acidic and alkaline solutions.

Keywords: Membranes, Thin film composite, Graphene oxide, Chlorine tolerance, Fouling resistance.
Economic efficiency of small mobile desalination system Powered by renewable energy in Egypt

Dalia E. Abo Zaid

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Egypt is experiencing a fresh water crisis. Many large and small communities in Egypt are suffering an acute shortage of fresh water that complies with minimum health requirements. Many desert areas require high investment funds to provide them with pure, drinkable water. Some of these areas face a wide range of technical and administrative problems that hinder the achievement of this goal. This research focuses on the integration of saline water and RO water desalination and hybrid solar photovoltaic (PV) technology. Solar driven Reverse Osmosis desalination can potentially break the dependence of conventional desalination on fossil fuels, reduce operational costs, and improve environmental sustainability. The research is based on an RO-PV driven prototype previously developed and successfully tested by the research team. The aim here is to determine the performance of the desalination unit, to measure their technical, allocative, and economic efficiencies. The Data Envelopment Analysis approach (DEA) is used to estimate the technical, allocative, and economic efficiencies of desalination unit in the North West cost of Egypt. Overall technical, allocative and economic efficiency measures estimated from the DEA approach and their frequency distributions with CRS and VRS are presented. Under the CRS assumption, the estimated mean TE measure for desalination unit is 86%, With the VRS model the mean technical efficiency was estimated to be 94%.The mean allocative (AE) and economic efficiency measures (EE) estimated from the DEA frontier are 93%, 87% for CRS, and 96%, 94 % for VRS respectively, indicating that costs could be reduced by approximately 7%, if the unit was allocatively efficient. The mean TE estimated for the desalination unit for the CRS and VRS, (DEA) approaches are 93% and 98 %. This result means that the small unit could produce the same level of output at approximately 7% less cost if the operation was technically efficient if CRS is assumed, or by 2% if VRS is assumed.

Keywords: Economic efficiency, small mobile desalination system, renewable energy, Egypt.
# Structures, Built and Natural Environment -SBNE05- Construction Technology

**Session Chairs:** Mohamed SOBAIH & Mohamed YOUSSEF

**Wednesday November 9th - Time: 3:30 PM – 5:15 PM**

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The Effect of Retrofitting Technique on the Structural Behavior of RC Columns

Amr I. I. Helmy

1 Assistant professor, Department of Structural Engineering, Ain Shams University, Egypt

Address: 1 El-Sarayat st., Abdou Basha Square, Abassia, Cairo, Egypt.

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* Corresponding Author

Civil engineers have been in search for new and effective methods of retrofitting to combat the high costs and effort of retrofitting of structures. For the past 40 years, Fibre Reinforced Polymer (FRP) is known as a class of composite material manufactured from fibres and resins that provides efficient and economical solution of retrofitting RC structures. Their use in these applications is predicted on performance attributes linked to their light-weight, high stiffness-to-weight and strength-to-weight ratios ease of installation in the field, potential lower systems level cost, and potentially high overall durability.

The paper presents a comparison between the retrofitting and testing of RC short columns using the Vacuum Assisted Resin Transfer Moulding method and the classical hand lay-up technique. VARTM is a reliable and repeatable process since it can save processing time specially when many FRP layers are being applied and makes the resin application more uniform compared with traditional hand lay-up method. A set of 8 RC columns 150 x 750 mm (square section x height) were cast using a 30 MPa concrete mixture. The mechanical properties of concrete were investigated namely, the concrete compressive strength, the tensile strength, modulus of rupture and the Young's modulus. The behaviour of RC columns under uniaxial compressive stresses were investigated to compare the effect of retrofitting technique and the number of GFRP wraps layers on the ultimate load carrying capacity, mode of failure and axial deformation. The ultimate load carrying capacities of retrofitted columns were estimated using Richard et al. model for confinement of columns. The ultimate load carrying capacity of retrofitted columns using the VARTM technique had remarkably surpassed the corresponding values for the hand lay-up method.

Keywords: RC columns, Retrofitting/Strengthening of structures; Fibre Reinforced Plastics FRP, GFRP, Confinement of concrete, VARTM technique, Hand lay-up method.
Modeling EPS Buffers behind Retaining Walls

Sherif S. ABDELSALAM1*, Salem A. AZZAM2, and Beshoy M. SHOKRY3

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Retaining walls are essential for deep excavation and other infrastructure projects with complex subsurface conditions. Design and construction of a lengthy walls is quite complex especially when the wall height exceeds 6 m, or when multi-anchors system is required to support the wall free length. In an attempt to reduce lateral earth pressures acting on rigid, flexible, and embedded walls, a compressible inclusion such as expanded polystyrene geofoam (EPS) is a durable material that can be used as a buffer between walls and soil backfills. In this paper, a numerical model was developed for various types of walls, using finite element (FE) program PLAXIS. The constitutive properties utilized in the model were characterization based on an extensive laboratory testing program, whereas various thicknesses of EPS were utilized and simulated in the FE analysis using the hardening soil constitutive model. The model results were verified by means of a simple physical prototype that was assembled to mimic the modeled wall types and the EPS buffers, in addition to comparing results with existing findings from the literature. From the main outcomes, the lateral pressure on rigid as well as flexible walls can be significantly reduced by using a relatively thin EPS buffer, and design charts were provided to determine the expected amount of reduction in the lateral pressure with respect to the buffer thickness.

Keywords: Geotechnical, Geosynthetics, Geofoam, Retaining walls, EPS buffer, Lateral pressure, modeling.
Studying the capability of using timber in improving the configuration of the urban context

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Nowadays the global worm is considered the main issue which orients all the engineers and architects towards innovating the eco efficient materials and systems that could be used in the urban context to minimize the carbon realized into the atmosphere since the industrial revolution.
Timber or wood, is considered one of the heritages, traditional and natural material that would never be neglected to be used in the architectural and urban context, as it has been used by the ancients in its simplest form, but by the development of technology and reaching the nanotechnology the usage of wood takes different scopes, which denotes some means of efficiency. Nowadays engineers and designers are using novel approaches to challenge conventional notions about wood construction.
The liability issue is to study; how could the innovative use of wood affect the current trajectory?
The main objective is to reach the main goals that could be achieved by wood in the urban context within the global technology which matches the eco efficiency.
The hypothesis is that: the flexibility is considered a main means of efficiency and wood has the flexibility in manufacturing good and durable urban contexts which match the eco efficiency.

Keywords: Timber, Eco efficiency, Flexibility, Urban context
Optimum Allocation of MR Dampers within Semi-Active Control Strategies of Three-Degree-of-Freedom Systems

Omar M. M. Elmeligy a, Maguid H.M. Hassan b

a Teaching Assistant, Faculty of Engineering, The British University in Egypt (BUE), AL-Sherouk City, Cairo, EGYPT
b Professor, M.ASCE, M.AISC, Dean of Engineering, The British University in Egypt (BUE), AL-Sherouk City, Cairo, EGYPT

Smart structural control is now emerging as an alternative to conventional earthquake resistant design and traditional structural control techniques. Fuzzy logic based control is one of the promising smart control strategies that could be used for this function. Magneto Rheological (MR) dampers are considered one of the promising semi-active control devices that can be used to control the structural response of buildings under earthquake excitation. The properties of MR dampers can be controlled using several smart techniques such as Fuzzy Logic.

In this paper, a comparative analysis is conducted to investigate the most optimum location for placing MR dampers, which are controlled by Fuzzy Logic, in a three-degree-of-freedom benchmark problem. The study explores three potential schemes for allocating and operating MR dampers within the system under consideration. Two main structural response parameters are considered in this study, maximum displacement and maximum acceleration. In addition, the study investigates the lowest number of fuzzy-controlled MR dampers that are required in order to produce the required structural behaviour. This is an initial step towards the development of a generic allocation algorithm that is capable of identifying the required number of MR dampers, and their location, for controlling any multi-degree-of-freedom system.

Keywords: Smart Systems, Fuzzy Logic, Structural Control, MR Dampers
Demolition of Steel Structures: Structural Engineering Solutions for a more Sustainable Construction Industry

Richard WALLS
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Corresponding Author

This paper presents an overview of structural demolition engineering as applied to steel structures. This work flows out of a research project initiated by Jet Demolition, aimed at providing design techniques for ensuring that structures can be both safely and efficiently demolished when they reach the end of their lifecycles. Currently demolition engineering is carried out based on “experience” with few calculation methods in existence.

When a structure is to be demolished or imploded it is typically weakened such that when the collapse is triggered the collapse mechanism can be controlled and will occur as predicted. The challenge that has been historically faced is that negligible research exists for verifying the load carrying capacity of weakened structures. If structures are not weakened enough they may not collapse when required, but if weakened too much they could collapse prematurely killing demolition teams. Furthermore, in practice clients have started requesting calculation procedures or engineering designs for the demolition procedures to be carried out on a project, and many contractors cannot provide such information.

This paper specifically discusses (a) a step-by-step analysis of the full-scale demolition of a large structure that the author filmed, explaining the structural mechanics of the system, and then (b) presents methods for weakening structures and how capacities can be predicted using simplified methods. Safety concerns often govern the techniques used for dismantling and demolishing a structure. Thus, by providing verifiable methods for ensuring structural capacity, rather than relying on experience alone, the demolition process can become more efficient, leading to the increased recyclability of structures. The demolition phase in the lifecycle of a building is critical in terms of its overall sustainability.

**Keywords:** Demolition, steel structures, safety, structural engineering, weakening techniques, building recyclability.
### Structures, Built and Natural Environment - SBNE06 - Smart Heritage-3

**Session Chairs:** Ali EID & Khaled DEWIDAR

**Wednesday November 9th - Time: 3:30 PM – 4:50 PM**

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Between the tangible & intangible Smart reading for heritage buildings

Gehan A.N. Radwan1, Sanaa Ibrahem Abd El Maksud2*

1 Assistant professor of architecture BUE, gehan.nagy@bue.edu.eg
2 Assistant professor of architecture and heritage consultant, Sanaamaksud@yahoo.com
* Dr. Gehan Ahmed Nagy Radwan

Information era have brought out several technologies that have added a lot into heritage, starting from documentation technologies, presentation technologies in addition to various dissemination techniques and technologies that connect the public with the heritage buildings and spaces. Nevertheless, HBIM technologies have provided more depth in dealing with heritage buildings in the scope of efficiency, retrofitting in addition to management. All the previous smart technologies have dealt with the tangible aspect of heritage providing a physical reading for buildings and spaces. This paper deals with the results of the use of technology in recording and documenting archaeological heritage buildings and the extent of its success in its goals, including the reading of history through the building to check the logic of the argument of Ebn Rushed in his book “The Incoherence of the Incoherence :;” If one looks into a made of any manufactures without perceiving the wisdom behind such made and the purpose intended, and if it does not stand originally with such wisdom, one might think it is possible that there are so made, which agreed in any form and any quantity agreed and put any agreed-volume and in whatever order”. Such argument will be investigated through the analysis of case studies with a proposed methodology to assess the results of retrofitting heritage buildings with the consideration of intangible historical aspect rather than tangible physical aspect.

Keywords: tangible heritage, intangible heritage, Building memory, hidden wisdom, smart reading.
The Potential of Living Labs for Smart Heritage Building Adaptation

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This year the European Network of Living Labs’ current president claimed ‘Living Labs act as intermediaries among cities, regions, firms, third sector and research organisations as well as citizens for joint value co-creation, rapid prototyping or validation to scale up and speed up innovation’. She proceeds to describe the consequential increasingly close relationship between Living Labs and the development of Smart Cities. Others argue that there is a strengthening drive to involving citizens in city development, so that urban areas may be rendered more suitable to their needs and social problems may be prevented. Meanwhile it is held that the value and significance of Heritage buildings and landscapes needs to be maintained, despite the increasing pressures to adapt all building stock to address climate change and reduce increasingly expensive energy use. To convincingly engage citizens, such adaptation needs to enhance rather than reduce quality of life for users. Over the last decade there has been a move to repeated post-occupancy evaluation (POE), including of some heritage building stocks, in order to ensure these goals continue to be achieved. Such POE involves both quantitative and qualitative measures. Yet it can be argued that the number of such POE studies is limited by shortages of expertise, to the extent that in most cases we still lack sufficient data about the existing building stock, and in particular Heritage buildings, to make reliably informed judgments on suitable adaptation and mitigation measures. At the same time the sustainable transformation of Heritage buildings and landscapes into Smart Heritage can be held to be a key component in the metamorphosis of existing cities into Smart Cities. This paper examines how Living Lab processes of engagement may deliver innovative approaches to POE, and thus support the scaling and speeding up of the transformation of Heritage into Smart Heritage.

Keywords: Living Labs; Smart Cities; Smart Heritage; Post Occupancy Evaluation; Community.
Heritage Preservation within public open spaces: the case of Kabel Street (Old Jeddah) Spacious Experience

Aida NAYER1*, Samaa RADY2
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Building Information Modeling provides a solid ground for historical areas documentation, whereas virtual experience of historic buildings is digitally constructed in order to maintain the building through its entire lifecycle. Jeddah Old Balad area, especially “Old Hajj Road”, is considered to be the core of heritage preservation. Therefore this paper elaborates on a platform demonstrating the potential of combining big data for main corridor in Old Balad by using GIS server, in addition to people reflections within outdoor spaces via smart sensors while experiencing the variety of urban features of the area. Therefore, the aim of this paper is to give an overview of people responsiveness, as well as surveying and representation of spacious data in order to support the process of further integration between HBIM and GIS tools to maximize the use of built heritage resources used for creating, conserving, documenting, and managing information which has a great impact on touristic and commercial activities within the case of Kabel Street. The study aims to strengthen the relation between future sustainable developments in this area within the explicit constraints of architectural heritage preservation.

Keywords: Historical Paths, Sustainable developments, HBIM, Smart Indicators, Sensors.
Ont-EIR Framework to Deliver Sustainable Heritage Projects

Shadan DWAIRI1, Lamine Mahdjoubi2*
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Informed retrofitting and maintenance is recognised as a cornerstone of sustainable heritage buildings. Clients and the construction team are concerned with the delivery of projects that are within the timescale, budget, as well as energy efficient and environmentally friendly. Indeed, they are increasingly being challenged to deliver sustainability performance of heritage projects. Employer Information Requirements (EIR) is now seen as essential for in any successful heritage building delivery.

When designing a sustainable BIM project it has to be made sure that a complete and comprehensive EIR is delivered at the beginning of the project, in order to be able to produce a sustainable and energy efficient building, the EIR has to assure delivery of a full package of sustainable requirements for the construction project team, which in turn will allow them to produce a complete and correct BIM Execution Plan (BEP) that will be the basis upon which the whole construction process and definition of roles and responsibilities will be based.

This paper discusses the design and development of an Ontology-based, BIM-enabled framework for EIR, which will support clients of smart-heritage projects to define their requirements in terms of sustainability. It will investigate the innovative approaches and methods used to produce a complete, correct, and comprehensive EIR. This framework will enable the heritage team to capture, analyse, and translate these requirements and convert them into constructional terms understood by all stakeholders, which covers all aspects needed to produce a smart-heritage project. The intention of this study is to save time, effort and cost, and in the same time provide an informed basis for delivering a successful project

Keywords: Heritage, smart, Sustainable, BIM, EIR.
## Emerging Technologies in Informatics-ETI04- Affective Computing

**Session Chair:** Doaa ALZANFALY

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<td>A Concept Analysis Scheme of Simple Stories for Learning Resources through Extraction of Domain-based Multimedia Elements</td>
<td>Masoudi MWIN YI, Jihad Mohamed ALJA’AM &amp; M. Samir ABOU E-SEOU D</td>
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<td>A Sentimental Analysis Tool for Determining the Promotional Success of Fashion Images on Instagram</td>
<td>Dahab Galal, Greg Tallent, Mohamed Abdel Fattah, Nada Hassan &amp; Doaa S. Elzanfaly</td>
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<td>5</td>
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<td>Immersive Virtual Reality in Improving Communication Skills in Children with Autism</td>
<td>Osama HALABI, Samir Abou EL-SEOU D, Jihad M. ALJA’AM, Hena ALPONA, Moza AL-HEMADI &amp; Dabia AL-HASSAN</td>
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Evaluation of the Vocal Tract Length Normalization Classifier for Speaker Verification

Walid B. HUSSEIN 1, Sarah A. ESSMAT 2

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Faculty of Informatics and Computer Science, The British University in Egypt, sarah.akram@bue.edu.eg

This paper proposes and evaluates classifiers based on Vocal Tract Length Normalization (VTLN) in a text-dependent speaker verification (SV) task with short testing utterances. This type of tasks is important in commercial applications and is not easily addressed with methods designed for long utterances such as JFA and i-Vectors. In contrast, VTLN is a speaker compensation scheme that can lead to significant improvements in speech recognition accuracy with just a few seconds of speech samples. A novel scheme to generate new classifiers is employed by incorporating the observation vector sequence compensated with VTLN. The modified sequence of feature vectors and the corresponding warping factors are used to generate classifiers whose scores are combined by a Support Vector Machine (SVM) based SV system. The proposed scheme can provide an average reduction in EER equal to 14% when compared with the baseline system based on the likelihood of observation vectors.

Keywords: speaker verification, vocal tract length normalization, fusion of multiple classifiers, SVM
Employing Information Extraction for building Mobile Applications

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In this paper, we describe a SMS-based information system called CATS, which allows posting and searching through free Arabic text using Information Extraction (IE) technology. We discuss the challenges of applying IE technology for unedited real Arabic text. In addition, we describe the structure of this system and our approach to produce an open robust system capable of including more sub domains with the minimum effort.

Keywords: Information Extraction, Arabic Language Processing, Classified Ads, Attribute Based Searching
A Concept Analysis Scheme of Simple Stories for Learning Resources through Extraction of Domain-based Multimedia Elements

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* Corresponding Author

Students with Special Needs (SP) have major difficulties in reading and understanding simple stories. Instructors need to use different methodologies to introduce story concepts, motivate the students and keep them engaged. These methodologies include: reading the story several times; showing glossy images of the main elements of the story; using symbols; taking students to sites; and even engaging the senses of taste and smell. The objective of this work is to build a system to assist the teachers of children with SP to improve the children’ understanding of stories using multimedia technology. The proposed solution is based on a domain-oriented architecture built around three domains: animals, food and trees. Different methodologies were used for text processing including concept analysis, sentence ranking, and algorithm-based extraction of keywords and linking automatically with multimedia elements (e.g. images and short clips). This method builds a corpus of keywords and associates them with multimedia elements and domain weights. The results of the evaluation show the efficiency of this approach in allowing children with SP to effectively understand simple stories within the selected domains.

Keywords: Special Education; Ontology; Keywords Extraction; Multimedia.
A Sentimental Analysis Tool for Determining the Promotional Success of Fashion Images on Instagram

DahabGalal ²* Greg Tallent ¹ Mohamed AbdelFattah ² Nada Hassan ² Doaa S. Elzanfaly ²

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Sentiment Analysis (SA) or Opinion Mining is the process of analysing natural language texts to detect an emotion or a pattern of emotions towards a certain product that can then be used to make a decision about said product. It’s a topic of text mining, Natural Language Processing (NLP) and web mining disciplines. Research in SA is currently at its peak given the amount of data generated from social media networks. The concept is that consumers are expressing exactly what they need, want and expect from a product but on the other hand the companies don’t have the tools to analyse and understand these feelings to satisfy these consumers accordingly. One of the applications that generate a high rate of reactions and sentiments in social networks is Instagram. This study focuses on analysing the reactions generated by the top 50 fashion houses on Instagram given their top 20 images with the highest number of likes. The approach taken in this study is to qualify the visual aesthetics of fashion images and to establish why some succeed on social media more than others. The basic question asked in this paper is whether there are certain visual aesthetics that appeal more to the user and are therefore more successful on social media than others as determined by a measure we introduce, ‘social value’. To do so, a sentiment analysis tool is developed to measure the proposed social value of each image. An input of comments from each image will be processed. Each comment will go through a preprocessing phase, then each word will be placed through a lexicon to identify if it is positive or negative. The output of the lexicon will go through a Naïve Bayes Algorithm to classify the comment as either positive, negative, or neutral. Adding to these results, the number of likes and shares would also be taken into consideration quantifying the image’s impact. A cumulative result is then produced to determine the social value of an image.

**Keywords:** Sentiment Analysis, Opinion Mining, Natural Language Processing, Instagram, Social Impact, Social Value, Aesthetics.
Immersive Virtual Reality in Improving Communication Skills in Children with Autism

Osama HALABI 1*, Samir Abou EL-SEOU2, Jihad M. ALJA’AM1, Hena ALPONA1, Moza ALHEMACI1, Dabia AL-HASSAN1

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Individuals in the Autism Spectrum often encounter situations where they have to respond to questions and situations that they do not know how to respond to, such as, questions asked by strangers including ones related to daily-life activities. A variety of research has been done to improve social and communication impairments in children with autism using technology. Immersive virtual reality is a relatively recent technology with a potential to bring an effective solution and used as a therapeutic tool to develop different skills. This paper presents a virtual reality solution to reduce the gap experienced by autistic children due to their inability to establish a communication. An interactive scenario-based system that uses role-play and turn-taking technique to evaluate and verify the effectiveness of immersive environment on the social performance of an autistic child. Preliminary testing of the system demonstrated the feasibility of VR-based system as a tool for improving the communication skill in ASD children. The results of the comparative usability study show the effectiveness of immersive VR in motivating and satisfying the autistic.

Keywords: Autism spectrum disorder; virtual reality; immersion; social performance; communication skill.
## Structures, Built and Natural Environment - SBNE07 - Urbanism & Design Studies

Session Chairs: **Ayman OTHMAN & Ahmed RASHED**

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<td>Gehan Ahmed Ebrahim</td>
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<td>“This Office Makes Me More Creative”: Creative Class Workers' Experiences in Innovative Office Spaces</td>
<td>Nanse Yassa, Maged Iscandar, Sherif Abdelmohsen &amp; Yasser Mansour, Ain Shams Univ.</td>
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<td>The Efficiency of Energy Developing Strategies on New Urban Settlements</td>
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<td>Examining the Impacts of integrating Sustainability Values into Creating Spaces for Children Case of SEKEM as a Sustainable Community and Business Model in Egypt</td>
<td>Laila KHODEIR &amp; Gehan NAGY</td>
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The feasibility study of designing the smart elderly Homes in an efficient way

Gehan Ahmed Ebrahim
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In the early eighties, the term “smart buildings” has appeared as technology concerning computer applications and means of communication and knowledge was developed and fitted to the buildings. So the technology seems to be the crucial corner in the architectural smartness. However, other concepts emerged today to complete the former picture of the smartness by adding the concept of meeting users’ needs. Thus, the concept of smart buildings is now known as those buildings which respond to the users’ requirements. While focusing on the smartness of the elderly homes special technological applications are taken in consideration to fulfill the psychological and physiological needs for the users, but those applications are too expensive. So the liability issue is to study how to fulfill the utmost needs of the elderly homes economically.

Keywords: smart technology, elderly homes, efficiency, psychological and physiological needs
"This Office Makes Me More Creative": Creative Class Workers' Experiences in Innovative Office Spaces

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The challenge in today's developed countries' global market is not the amount of production as much as the creativity in such production. Technology in the office spaces - as a major factor - is playing an important role in changing the nature of work, and creativity as an output is an important issue of research. Creativity at the workplace has been a subject of study for the last years and this paper aims to identify the workplace as a factor that support or discourage creativity from the point of view of its users. Data is collected from both related literatures review and survey study. The direct link between the workplace and creativity is not well defined but biased or incomplete in literature and it needed more practical elaboration to be considered; and that was the aim from the survey study. The survey samples were chosen from both tangible and non-tangible international creative firm's employees located in Egypt. Samples were chosen according to their will and interest to participate in the research topic. The paper main vision is to consider the challenges of investigating the subjective experiences of creative class workers in the physical workplace while presenting its impact on their creativity. The results were concluded from three offices field work; through in-depth interviews, focus groups meetings, long term field observations, photographs, and field notes. It showed how creative class workers gave support to the benefits of working in interactive workplace. Positive discussions keep up the substantial impact of the physical workplace and were supporting the idea of work enjoyment and confirmed the fact that being in the right workplace does matter. Furthermore, it is a key factor for enhancing their outcome that direct benefit the organization as well as happier and healthier well-being.

Keywords: Technology; Creativity; workplace; Innovative office spaces; Creative class workers.
Due to the Global warming, climate change and the scarcity of energy recourses a new approaches has to be taken from the Governments and it's institutions to regulate and encourage private sector-led urban development projects. Sustainable development has generated wide attention among scholars in the academic domains of spatial planning and real estate. However, limited academic attention has been paid to sustainability at the intermediate operational level of urban development projects (UDPs). Across the globe sustainable private sector-led urban development projects (SPUDPs) in the built environment rarely commence as real estate developers face several Governmental obstacles and barriers which limit their capacity to develop economic-viable, social-responsible, environmental-friendly urban places. Hence, SPUDPs are a promising development strategy for cities as the scale of such projects could be an effective means to integrate public planning policies and private development decisions with a broader social impact as opposed to solely developing sustainable buildings. However, it is largely unknown how SPUDPs can be effectuated as insight is lacking into institutional conditions that could incentivize real estate developers to make decisions for sustainable urban development practices. This paper explores the institutional conditions, in particular the policy instruments from local planning authorities that nudge private decision-making to realize SPUDPs, by means of a literature review resulting in a conceptual model. The paper reveals that developers can be incentivized by pro-active local planning bodies using a combination of planning policy instruments which foster a sustainability-sensitive market decision-making environment.

Keywords: sustainable urban development projects-institutional conditions-real estate developers-local planning authorities- market decisions.
The Efficiency of Energy Developing Strategies on New Urban Settlements

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Energy supply becomes more recently the backbone of all modern service, information and industrial. The global energy consumption has doubled in the past century and the availability of non-renewable fuel resources started to become a problem. The world started to take actions in order to face the shortage of non-renewable resources by investigating other solutions relaying on renewable resources. The role of energy conservation is growing in parallel to the growth of global problems due to environmental global problems. The concern of this research is that the cities in the 3rd world such as Egypt are facing a shortage in the power supply due to economic and urban expansions. The government of these countries can’t provide the energy demand to the community.

The aim of this study is to focus on the problem of the shortage in the traditional resources of energy and its effect on urban growth in Egypt by presenting four developing strategies that conserve energy and environmentally friendly. These four developing strategies shows a high potential and the capabilities of the non-traditional resources of energy such as solar energy, wind energy, waves energy, etc) which should be taken in consideration in the new planning era in Egypt. The research will present useful examples and case studies that applied these four developing methods and became environmental friendly cities and energy saving cities. These four developing strategies will affect the city economic state and reducing the growth of global problems and help in creating sustainable cities that’s why they should be applied in any new city in Egypt.

Keywords: Fossil Fuel, Energy, Wind, solar, Landscape and Renewable energy.
Examining the Impacts of integrating Sustainability Values into Creating Spaces for Children Case of SEKEM as a Sustainable Community and Business Model in Egypt

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The increasing awareness of resources’ depletion and environmental deterioration forced impact on Reconsidering mutual environmental impacts between architecture and the natural environment. This trend led naturally to adopting the concepts of sustainability in design. However, such trends manifestation can be claimed as slightly existing in the local Egyptian architecture. Egypt is still away from applying those concepts as a lifestyle, awing to the fact that these a lifestyle takes a lifelong commitment – to learn, experiment, explore, and commit to increasingly sustainable practices. A successful approach to overcome such problems is to embed sustainability values into the lifestyle of children, who will consequently pass them to their families, and community. This could be feasible through the design of spaces, children could learn values of sustainability from.

Thus the aim of this paper is double-fold; to investigate techniques and methods that could help in creating a place for kids, that is capable of teaching them socio-cultural, economic and physical sustainability and to examine the effect of embedding values of sustainability in the design of spaces that are designed by adults, but experienced by children. The utmost aim is to establish a platform to bring a generation that consider sustainability as a life style and an essence for achieving wellbeing. To achieve the objective of the paper, a literature review was conducted in order to make clear the design consideration for such spaces, and to elaborate techniques used as state of the art in creating sustainable spaces for children. In addition, a case study project; SEKEM community project, was analyzed through applying interviews, observation and questionnaire survey. The results of this study are expected to influence the practice of creating sustainable spaces for children and the setting of design priorities for action to improve sustainable communities.

Keywords: Sustainability; Human Development; Community Engagement; Community Services.
Towards Sustainable Slums: Fire Safety Engineering for Informal Settlements

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Soon one billion people (UN 2012) worldwide will live in informal settlements (slums), and these areas are often ravaged by fires. Fire safety engineering for informal settlements has been historically neglected by both engineering consultants and academics due to the challenges faced when implementing solutions. However, this paper presents an overview of the problem of fires in informal settlements and the potential for using engineering methods in addressing such issues. Research work is based primarily on data from South Africa, especially Cape Town, although the research is generally applicable to areas worldwide. Informal settlements can become more economically, socially and environmentally sustainable when dwellings, or “shacks”, are not being regularly razed to the ground.

A brief introduction is provided regarding fire dynamics in small enclosures, and how such behavior influences possible solutions. When deaths occur in informal settlement fires it is usually the person in the shack of origin that is killed (Eksteen 2016). Furthermore, it is important that the difference between smouldering and flaming fires be understood as they kill people in different ways and also define what systems are suitable in each scenario. By understanding the engineering components of both fire and human movement in such events municipalities can improve access to areas during a fire and provide more efficient disaster response. For instance, during a large fire human movement is restricted by inhabitants moving furniture into pathways with the hope of transferring it to safer areas. Thus, standard evacuation models cannot be applied as evacuation routes have time-dependent flow rates through aisles.

The context of implementing engineering solutions in an area post-fire is provided. After a large conflagration informal settlements are rapidly reconstructed, often within 24 or 48 hours. Thus, redeveloping areas according to a well laid-out plan is typically not an option as municipalities cannot act sufficiently quickly. Rather, it is proposed that when tenure of land is guaranteed for residents then solutions can be implemented by progressively providing services to a stable community.

**Keywords:** Informal settlements, fire safety engineering, sustainable slums, poverty.