



THE ATHENS INSTITUTE FOR EDUCATION AND RESEARCH

# Abstract Book

**3<sup>rd</sup> Annual International Conference on  
Mechanical Engineering  
22-25 July 2019, Athens, Greece**

Edited by  
Gregory T. Papanikos

2019



Abstracts  
3<sup>rd</sup> Annual International  
Conference on Mechanical  
Engineering  
22-25 July 2019, Athens,  
Greece

Edited by Gregory T. Papanikos

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# Preface

This book includes the abstracts of all the papers presented at the *3<sup>rd</sup> Annual International Conference on Mechanical Engineering (22-25 July 2019)*, organized by the Athens Institute for Education and Research (ATINER).

In total 28 papers were submitted by 30 presenters, coming from 17 different countries (Australia, Canada, China, Egypt, France, Germany, Hungary, India, Japan, Lebanon, Qatar, Romania, Saudi Arabia, Spain, Turkey, UK, and USA). The conference was organized into 10 sessions that included a variety of topic areas. A full conference program can be found before the relevant abstracts. In accordance with ATINER's Publication Policy, the papers presented during this conference will be considered for inclusion in one of ATINER's many publications.

The purpose of this abstract book is to provide members of ATINER and other academics around the world with a resource through which to discover colleagues and additional research relevant to their own work. This purpose is in congruence with the overall mission of the association. ATINER was established in 1995 as an independent academic organization with the mission to become a forum where academics and researchers from all over the world could meet to exchange ideas on their research and consider the future developments of their fields of study.

It is our hope that through ATINER's conferences and publications, Athens will become a place where academics and researchers from all over the world regularly meet to discuss the developments of their discipline and present their work. Since 1995, ATINER has organized more than 400 international conferences and has published nearly 200 books. Academically, the institute is organized into 6 divisions and 37 units. Each unit organizes at least one annual conference and undertakes various small and large research projects.

For each of these events, the involvement of multiple parties is crucial. I would like to thank all the participants, the members of the organizing and academic committees, and most importantly the administration staff of ATINER for putting this conference and its subsequent publications together. Specific individuals are listed on the following page.

**Gregory T. Papanikos**  
**President**

**3<sup>rd</sup> Annual International Conference on Mechanical  
Engineering  
22-25 July 2019, Athens, Greece**

**Scientific Committee**

All ATINER's conferences are organized by the [Academic Council](#). This conference has been organized with the assistance of the following academics, who contributed by a) setting up the program b) chairing the conference sessions, and/or c) reviewing the submitted abstracts and papers:

1. Gregory T. Papanikos, President, ATINER & Honorary Professor, University of Stirling, UK.
2. Nikos J. Mourtos, Professor & Chair, Aerospace Engineering, San Jose State University, USA.
3. Bala Maheswaran, Professor, Northeastern University, USA.
4. Mustafa Bakkal, Professor, Istanbul Technical University, Turkey.
5. Hemchandra Shertukde, Professor, University of Hartford, USA.
6. Salaheldin Doma, Professor, Alexandria University, Egypt.
7. Attila Kovari, Associate Professor, Head of Department, University of Dunaujvaros, Hungary.
8. Muthuramalingam Thangaraj, Associate Professor, SRM Institute of Science and Technology, India.
9. Olga Gkounta, Researcher, ATINER.



**FINAL CONFERENCE PROGRAM**  
**3<sup>rd</sup> Annual International Conference on Mechanical Engineering, 22-25**  
**July 2019, Athens, Greece**

**Conference Venue:** Titania Hotel, 52 Panepistimiou Avenue, Athens, Greece  
(close to metro station *Panepistimio*)

**Monday 22 July 2019**

**07:50-08:40 Registration and Refreshments**

**08:50-09:20 (Room A - 10<sup>th</sup> Floor): Welcome and Opening Address by Gregory T. Papanikos, President, ATINER.**

**09:30-11:00 Session I (Room A - 10<sup>th</sup> Floor): Applied Mechanics & Design**

**Chair:** Nikos J. Mourtos, Professor & Chair, Aerospace Engineering, San Jose State University, USA.

1. Mustafa Bakkal, Professor, Istanbul Technical University, Turkey, Eray Celik, R&D Manager, Yilmaz Machine, Turkey, Azmi Timur, Research Assistant, Istanbul Technical University, Turkey, Mete Kayihan, Research Assistant, Istanbul Technical University, Turkey, Murat Sesen, Student, Istanbul Technical University, Turkey, Selen Ates, Student, Istanbul Technical University, Turkey & Mahmut Yilmaz, Engineer, Yilmaz Machine, Turkey. Building a New Bridge between University-Industry Collaboration: An Engineering Design Case Study.
2. Dan Dumitriu, Senior Scientific Researcher, Solid Mechanics Institute of the Romanian Academy, Romania, Daniel Octavian Melinte, Scientific Researcher, Solid Mechanics Institute of the Romanian Academy, Romania, Marius Ionescu, Assistant Researcher, Solid Mechanics Institute of the Romanian Academy, Romania & Mihai Margaritescu, Senior Scientific Researcher, Solid Mechanics Institute of the Romanian Academy, Romania. Scissor-Type Grasping Tool for Electric Parallel Gripper Equipping a Mobile X-Y-Z Robotic System.
3. Fang Zhao, PhD Student, School of Mechanical Science and Engineering, Huazhong University of Science and Technology, China, Youmin Hu, Professor, School of Mechanical Science and Engineering, Huazhong University of Science and Technology, China, Bo Wu, Professor, School of Mechanical Science and Engineering, Huazhong University of Science and Technology, China, Tielin Shi, Professor, School of Mechanical Science and Engineering, Huazhong University of Science and Technology, China & Rutao Ma, CNPC Engineering Technologies R&D Company, China. Structural Design and Dynamic Analysis of a New Drill Floor Robot.
4. Royd Johansen, MSc Student, San Jose State University, USA & Nikos Mourtos, Professor, San Jose State University, USA. Aircraft Dynamic Analysis for an Advanced Military Trainer Conceptual Design.
5. ChaKaria Hunter, Graduate Student, San Jose State University, USA & Nikos Mourtos, Professor, San Jose State University, USA. Design of a New Generation Supersonic Transport Aircraft.

**11:00-12:30 Session II (Room A - 10<sup>th</sup> Floor): Teaching & Learning**

**Chair:** Olga Gkounta, Researcher, ATINER.

1. Costas Efthimiou, Associate Professor, University of Central Florida, USA, Elena Flitsiyan, Associate Lecturer, University of Central Florida, USA & Talat Rahman, Professor, University of Central Florida, USA. Assessment of the Effect of Service

- Learning in Introductory Physics on Students Learning and Critical Thinking.
2. \*Attila Kovari, Associate Professor, Head of Department, University of Dunaujvaros, Hungary. Education Perspectives of Human-Computer Interfaces.
  3. Manuel Condoleon, Lecturer, Australian Catholic University (ACU), Australia. Talk The Tok and Walk The Wok: How International Bacalaureate Subject Teachers Integrate Theory of Knowledge in their Teaching (Case Studies in India, Thailand and China).

**12:30-13:30 Session III (Room A - 10<sup>th</sup> Floor): STEAM: Institution Experiences**

- Chair:** Attila Kovari, Associate Professor, Head of Department, University of Dunaujvaros, Hungary.
1. Andreas Karatsolis, Associate Director of Writing, Rhetoric and Professional Communication, Massachusetts Institute of Technology (MIT), USA. Integrating Communication and STEM through Stasis Theory at MIT.
  2. Aymen Elsheikh, Instructional Assistant Professor, Texas A&M University at Qatar, Qatar. STEAM Education at an American Branch Campus in Qatar.

**13:30-14:30 Lunch**

**14:30-16:00 Session IV (Room A - 10<sup>th</sup> Floor): Materials**

- Chair:** Salaheldin Doma, Professor, Alexandria University, Egypt.
1. Hussein Motaweh, Professor, Damanhour University, Egypt & Marwa Nabil, Associate Professor, Advanced Technology and New Materials Research Institute, Egypt. Porous Silica as a Master Material in Various Applications.
  2. Madalina Simona Baltatu, Assistant Professor, "Gheorghe Asachi" Technical University of Iasi, Romania. Electrochemical Behaviour of New Ti-based Alloys, Ti-Mo-Zr-Ta vs. Ti-Mo-Si.
  3. Adam Lantos, Postgraduate Student, The University of Edinburgh, Scotland, UK & Konstantinos Mouloupoulos, Associate Professor, University of Cyprus, Cyprus. Topology in Modern Solid State Physics: From Topological Insulators to Weyl Semimetals.

**16:00-18:00 Session V (Room A - 10<sup>th</sup> Floor): ATINER's 2019 Series of Academic Dialogues: The Future of STEAM (Sciences, Technology, Engineering, Arts and Mathematics) Education**

- Chairs:** Olga Gkounta, Researcher, ATINER.
1. Bala Maheswaran, Professor, Northeastern University, USA. STEAM Education through Experiential Learning.
  2. Ellene Tratras Contis, Professor of Chemistry, Eastern Michigan University, USA. Community-based/STEM Experiential Learning: Is it STEAM?
  3. Nikos J. Mourtos, Professor & Chair, Aerospace Engineering, San Jose State University, USA. STEAM Education in the 21<sup>st</sup> Century: Are we Neglecting the "A"?
  4. Ethel Petrou, Professor and Chair, Department of Physics, Erie Community CollegeSouth, State University of New York, USA. The Many Faces of STEAM at a Community College in Western New York.

**21:00-23:00 Greek Night and Dinner**

**Tuesday 23 July 2019**

**07:45-10:45 Session VI: An Educational Urban Walk in Modern and Ancient Athens**

Group Discussion on Ancient and Modern Athens.  
Visit to the Most Important Historical and Cultural Monuments of the City (be prepared to walk and talk as in the ancient peripatetic school of Aristotle)

**11:15-13:00 Session VII (Room A - 10<sup>th</sup> Floor): Machine Learning, Optimization and Other Issues**

**Chair:** Hemchandra Shertukde, Professor, University of Hartford, USA.

1. Nikos J. Mourtos, Professor & Chair, Aerospace Engineering, San Jose State University, USA. The Boeing 737 Max: A Systems Approach to Analyzing what Went Wrong.
2. Ahmed Lakhssassi, Titular Professor, Director of the Engineering Module, Department of Computer Science and Engineering, University of Quebec Outaouais, Canada. Multi-Heat Sources Silicon-Die Thermal Monitoring Using Embedded Sensor Cells Unit.
3. Adrian Ionescu, Professor, Wagner College, USA. Polynomial Interpolation and Some New Autonomous Numerical Methods.
4. Elena Niculina Dragoi, Assistant Professor, Gheorghe Asachi Technical University of Iași, Romania, Lucian Eva, Medical Doctor, "Prof. Dr. Nicolae Oblu" Emergency Hospital, Romania, Vlad Dafinescu, Bioengineer, "Prof. Dr. Nicolae Oblu" Emergency Hospital, Romania, Alexandru Cosmin Apetrei, Medical Doctor, "Prof. Dr. Nicolae Oblu" Emergency Hospital, Romania & Dana Mihaela Turliuc, Associate Professor, "Grigore T. Popa" University of Medicine and Pharmacy, Romania. Modelling with Nature Inspired Optimizers and Artificial Neural Networks. Case Study: Phenol Adsorption.
5. Reto Daniel Wettstein, MSc Student, Heilbronn University of Applied Sciences / University of Heidelberg, Germany & Christian Fegeler, Professor, Heilbronn University of Applied Sciences, Germany. Real-Time Body Temperature and Heart Rate Monitoring System for Classification of Physiological Response Patterns Using Wearable Sensor and Machine Learning Technology.

**13:00-14:30 Session VIII (Room A - 10<sup>th</sup> Floor): Energy Conversion and Efficiency, Electric Vehicles and Combustion Engines**

**Chair:** Muthuramalingam Thangaraj, Associate Professor, SRM Institute of Science and Technology, India.

1. Hemchandra Shertukde, Professor, University of Hartford, USA. Improvements in the REVOLT Pure Electric Drag Racer by GREEN 707 Club.
2. Alexandre De Bernardinis, Research Scientist, IFSTTAR, France. Multi-Phase Silicon Carbide Interleaved DC/DC Converter for Fuel Cell or Storage Applications.
3. Nicolas Saba, Associate Professor, University of Balamand, Lebanon. Analysis and Modification of the Tailoring Method in Hot Stamping Processes.
4. Ayhan Uyaroglu, Assistant Professor, Selçuk University, Turkey, İlker Ors, Assistant Professor, Selçuk University, Turkey, Mahmut, Unaldi, Assistant Professor, Selçuk University, Turkey, Murat Civiz, Professor and Head of Mechanical Engineering Department, Selçuk University, Turkey & Bahar Sayin Kul, Researcher, Selçuk University, Turkey. The Benefits of Fuel Additives Used in Internal Combustion Engines.

**14:30-15:30 Lunch**

**15:30-16:30 Session IX (Room A - 10<sup>th</sup> Floor): STEAM: Special Topics**

**Chair:** Bala Maheswaran, Professor, Northeastern University, USA.

1. Angel Vazquez-Alonso, Professor and Researcher, University of the Balearic Islands, Spain & Maria-Antonia Manassero-Mas, Professor and Researcher, University of the Balearic Islands, Spain. An Elaboration on the Interface between STEM and Art Searching for Convergences.
2. Eunyoung Kim, Associate Professor, Japan Advanced Institute of Science and Technology, Japan. STEAM Education in the Context of the Educational Innovations in Graduate Schools.

**16:30-18:00 Session X (Room A - 10<sup>th</sup> Floor): Manufacturing & Materials**

**Chair:** Mustafa Bakkal, Professor, Istanbul Technical University, Turkey.

1. Steven Le Corre, Professor, University of Nantes, France. Residual Stresses Prediction in Composite Materials Manufacturing: A Multiscale Combined Experimental and Numerical Approach.
2. Muthuramalingam Thangaraj, Associate Professor, SRM Institute of Science and Technology, India & Vasanth Swaminathan, Assistant Professor, SRM Institute of Science and Technology, India. Multi Criteria Decision Making of Power Diode based Process Parameters in Laser Beam Machining Using Taguchi-DEAR Methodology.
3. Ahmed Sabry Abdel-Rahman, Associate Professor, Cairo University, Egypt. Measuring the Internal Friction of some Rubber Composites doped Nanocarbon using the Laser Shadowgraphy Pulse Excitation Technique.
4. Marwa Elnady, Researcher Assistant, Central Metallurgical Research and Development Institute, Egypt, Gamal Saad, Professor, Cairo University, Egypt, Alaa Eid, Researcher, Central Metallurgical Research and Development Institute, Egypt & Malak Abou El-khair, Professor, Central Metallurgical Research and Development Institute, Egypt. Effect of PP Grafted p-Hydroxy-N- Phenyl Maleimide Comptabilizer and Organoclay Percent on the Properties of Polypropylene/Organoclay Nanocomposites.

**20:30-22:00 Dinner**

**Wednesday 24 July 2019**  
**Mycenae and Island of Poros Visit**  
**Educational Island Tour**

**Thursday 25 July 2019**  
**Delphi Visit**

**Friday 26 July 2019**  
**Ancient Corinth and Cape Sounion**

**Ahmed Sabry Abdel-Rahman**  
Associate Professor, Cairo University, Egypt

## **Measuring the Internal Friction of some Rubber Composites doped Nanocarbon using the Laser Shadowgraphy Pulse Excitation Technique**

Internal friction is a very important mechanical property of matter which can be determined by many techniques, such as the pulse excitation technique and the torsional pendulum. In this paper we used the pulse excitation technique as it is non-contact, easy used and not affecting the sample, reliable, low cost, and accurate and suiting a wide variety of rubbery materials and elastomers. The samples chosen for this work is made of butadiene acrylonitrile rubber (NBR), which are loaded by different phr of N774 nanocarbon. The measured sample is prepared in form of 200 mm long string, having a homogenous circular cross-section of 3 mm diameter. A mechanical pulse is produced and delivered to the fixed end sample by mean of a punch from a small solenoid motor plunger. To generate a shadowgraph for the vibrating sample on a silicone photodiode, a laser beam is used. A storage oscilloscope is used to capture the natural resonance amplitude decay profile of the test sample from the obtained electric signal. The internal friction is obtained by mathematical analysis of the acquired data.

**Mustafa Bakkal**

Professor, Istanbul Technical University, Turkey

**Eray Celik**

R&D Manager, Yılmaz Machine, Turkey

**Azmi Timur**

Research Assistant, Istanbul Technical University, Turkey

**Mete Kayihan**

Research Assistant, Istanbul Technical University, Turkey

**Murat Sesen**

Student, Istanbul Technical University, Turkey

**Selen Ates**

Student, Istanbul Technical University, Turkey

&

**Mahmut Yilmaz**

Engineer, Yılmaz Machine, Turkey

## **Building a New Bridge between University-Industry Collaboration: An Engineering Design Case Study**

The main goal of this project is to establish a new bridge between university and industry in order to solve the production difficulty in an industrial company. Defined problem is solved using alternative design ideas originated from engineering undergrad students under the supervision of academic and industry-professional personnel in current study. In analyzed case, assembly purpose chassis rotating with a high mass is very problematic process, not only for production effectiveness but also for operators as well. According to the need of the industrial company, Yılmaz Machine, undergrad students which enrolled the applied manufacturing design course had worked as groups and designed different solutions for lifting and rotating chassis safely. The new design should be able to allow that 200 kilograms' empty chassis could be raised for desired height for operations and rotated 90 degrees. After the finishing of assembly processes, chassis which weight raised to 600 kilograms should be able to place back to ground. At the beginning of the design stage, all the necessary analytical calculations and various finite element analysis (FEA) studies has been done for a safe design. Weekly meetings was conducted by university instructors during the design stage. After detailed evaluations of the different design alternatives by the students and industry professionals, project groups had finalized their design proposals and were handed out to the company. The company evaluated each project in detail according to the safety, cost and manufacturability point of view, then forwarded feedback into groups. For realization steps, the students studied in university labs. All finalized and realized projects were evaluated with engineering criteria by

company officials, faculty member and technicians in a final competition. The best design was selected to be manufactured in Yılmaz Machine and one of the assembly problem of the company had been solved.

It is important that the final machine design was automation-based and sustainable. This brings great opportunity for cost-effective production in industry. Furthermore, the safety conditions have been provided in terms of engineering approaches such as analytical calculations and simulations based on FEA.

**Madalina Simona Baltatu**

Assistant Professor, "Gheorghe Asachi" Technical University of Iași,  
Romania

### **Electrochemical Behaviour of New Ti-based Alloys, Ti-Mo-Zr-Ta vs. Ti-Mo-Si**

Ti-based alloys are widely used in medical applications, in the last decade. In order not to produce side effects, many kinds of titanium alloys must be composed with different non-toxic elements (Zr, Ta, Mo, Si, Nb etc.), thus interact well with adjacent bone tissues. The present study explores the electrochemical responses of different Ti-based alloys as Ti-Mo-Zr-Ta or Ti-Mo-Si systems designed for medical applications. The alloys electrochemical corrosion resistance was determined in Ringer solution using linear potentiodynamic polarization tests (LPP). For the new materials was identified a spontaneously passivation oxide film on their surface and they remained stable for polarizations. No localized breakdown of the oxide layers could be evidenced.

*This work was supported by a grant of the Romanian Ministry of Research and Innovation, CCCDI – UEFISCDI, project number PN-III-P1-1.2-PCCDI-2017-0239 / 60PCCDI 2018, with in PNCDI III.*



**Manuel Condoleon**

Lecturer, Australian Catholic University (ACU), Australia

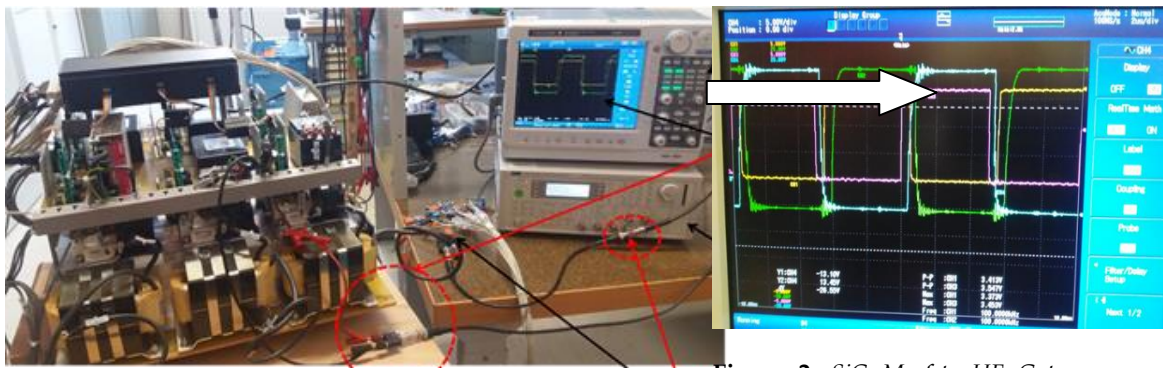
**Talk The Tok and Walk The Wok:  
How International Baccalaureate Subject Teachers Integrate  
Theory of Knowledge in their Teaching (Case Studies in  
India, Thailand and China)**

This study explored how teachers of the International Baccalaureate Diploma Programme integrated the Theory of Knowledge (TOK) course in their teaching. The inter-disciplinary nature of TOK embraces STEAM for it explores questions about the nature of knowledge with a particular focus on the connections between ways of knowing and areas of knowledge such as Arts, Mathematics and the Natural Sciences. It is a compulsory element of the International Baccalaureate Diploma Programme (IBDP) as all teachers are expected to include TOK in their teaching, however teachers have often expressed a sense of confusion and lack of confidence when teaching TOK. Education scholars have also questioned the appropriateness of TOK for students of non-Western cultures considering it has grown from a programme with a strong Western humanist tradition and dominated by the Western languages. Against this backdrop, however, the International Baccalaureate (IB) is experiencing its strongest growth in the Asia-Pacific region. This study therefore sought to explore some of the ways in which TOK is interpreted, adapted and implemented in the IBDP across non-Western contexts. A qualitative case study methodology was employed focusing on three international schools, one in India, one in Thailand and one in China. The study considers the views and practices of subject teachers relating to TOK across the multiple case study schools, which in turn raises issues for future pedagogical practice such as strategies for the successful collaboration of educators in promoting STEAM especially from a more critical and epistemological standpoint.

**Alexandre De Bernardinis**  
Research Scientist, IFSTTAR, France

## Multi-Phase Silicon Carbide Interleaved DC/DC Converter for Fuel Cell or Storage Applications

Wide band-gap semiconductors, and in particular Silicon carbide (SiC) ones, are nowadays becoming more and more used in electrical and energetic power applications. Their advantages, in terms of high frequency, high working temperature, and low dynamic losses lead to simplified cooling systems avoiding the use of complex water circuits, and compact design for the power converter. This contribution will focus on the use of a new-market Silicon carbide technology for the design of DC/DC multi-phase interleaved converter for Fuel cell application [1-3]. Potentialities of the SiC semiconductor components will be exposed in particular linked with high switching frequencies, managed junction temperatures, and efficiencies. Design considerations with control strategies (like for example the part-load methodology), driver card sizing, will be presented for the fuel cell application in order to have a high mass/volume density, and also fault-tolerant architecture for the interface converter. The 20kW prototype converter (in Figure 1) fully designed in the laboratory is composed of 6 half-bridge legs equipped with SiC MOSFETs. Voltage and switching tests have been performed up to 350V DC, 50A per phase, for a switching frequency of 100 kHz (Figure 2), as well as the evaluation of the driver cards and switching losses for the SiC MOSFETs devices.



**Figure 1.** Multi-phase DC/DC Converter and SiC MOSFETs Gate Control

**Figure 2.** SiC Mosfets HF Gate Signals. (Cokogawa DL850® Fast Digital Oscilloscope Display and Recording)

**Elena Niculina Dragoi**

Assistant Professor, Gheorghe Asachi Technical University of Iași,  
Romania

**Lucian Eva**

Medical Doctor, "Prof. Dr. Nicolae Oblu" Emergency Hospital, Romania

**Vlad Dafinescu**

Bioengineer, "Prof. Dr. Nicolae Oblu" Emergency Hospital, Romania

**Alexandru Cosmin Apetrei**

Medical Doctor, "Prof. Dr. Nicolae Oblu" Emergency Hospital, Romania

&

**Dana Mihaela Turliuc**

Associate Professor, "Grigore T. Popa" University of Medicine and  
Pharmacy, Romania

## **Modelling with Nature Inspired Optimizers and Artificial Neural Networks. Case Study: Phenol Adsorption**

Modelling different real-world complex systems is a difficult task, especially when the chemical and chemical laws governing the system are not fully known. In this context, the artificial neural networks (ANNs) come as good alternatives to the standard phenomenological models. Although easy to use, the identification of the optimal characteristics of ANNs has a series of issues, as the parameters are problem dependent and clear rules regarding their determination are not yet determined. Neuro-evolution (the application of an evolutionary algorithm -EA- to automatically set the topology and/or the internal parameters of an ANNs) is an approach that can relieve the end user from this daunting task. On the other hand, literature presents numerous algorithms that, although are not EAs in the strictest way of the word, are similar to EAs (through steps, method of solution determination, source of inspiration) and therefore, can be included in the neuro-evolutive process. These algorithms are known as nature-inspired metaheuristics and in this work, the performance of three approaches (Differential Evolution -inspired from the Darwinian principle of evolution-, Differential Search -inspired from the Brownian motion of animals- and Fireworks Optimization -inspired from the mechanisms of fireworks-) were tested. The objective was to determine which of the three algorithms is better suited to perform the optimization of the search space represented by the parameters of the ANNs. As a case study, a chemical process represented by the phenol absorption on scoria stone modified with nitric acid was selected. A set of experimental data gathered under various conditions (which are published in Sharafi et al., 2019) represent the details of the process used by the ANN to determine the best relations between inputs (absorbent dosage, contact time, phenol concentration) and the output (phenol

removal). The obtained results showed that all three optimizers determined good ANNs models for the considered process. However, using the same settings (population dimension and number of iterations), the number of function evaluations (FEs) used by each algorithm differs significantly. As a result, alterations were performed to limit the FEs to a specific value. Fireworks Optimization outperformed the other algorithms, the average absolute error obtained in the testing phase being 2.61%.

*This work was supported by "Program 1. Development of the national system for research and development. Postdoctoral research projects" financed by UEFISCDI, project PNIII-RU-PD no. 23/2018.*

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**Scissor-Type Grasping Tool for Electric Parallel Gripper  
Equipping a Mobile X-Y-Z Robotic System**

In the framework of national PCCDI project entitled “Autonomous robot systems for waste management in the context of smart city”, contract no. 22 PCCDI /2018, the idea is to build a mobile robotic system, carrying a x-y-z robotic manipulator equipped with an electric parallel gripper. The gripper is intended to collect waste objects from the ground and to manipulate them to a box container placed on the mobile robot.

This paper presents a scissor-type grasping tool to be mounted on a FESTO HGPLE-14 gripper, equipping the x-y-z robotic system conceived for grasping waste objects. This scissor-type grasping tool represents an alternative to classical rigid BUB-HGPL fingers or to adaptive gripper fingers DHAS-GF, provided by FESTO as gripper grasping tools.

The idea is to study a different type of grasp, the proposed scissor-type grasping tool fulfilling also the role of stroke enhancement adapter.

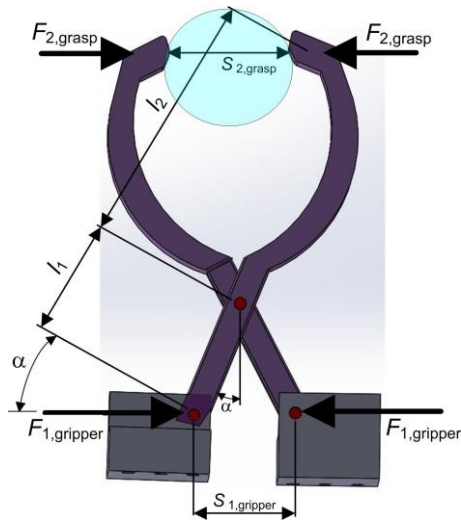
The following relationship holds between the total stroke  $s_{1,gripper}$ , the gripping force  $F_{1,gripper}$ , the corresponding grasp opening  $s_{2,grasp}$  and the grasping force  $F_{2,grasp}$  provided at the other end of the scissor-type grasping tool, where the object is grasped:

$$F_{1,gripper} s_{1,gripper} = F_{2,grasp} s_{2,grasp}$$

Thus, this scissor-type grasping tool is really a stroke enhancement adapter: one can achieve an increased grasp opening  $s_{2,grasp} > s_{1,gripper}$  the drawback being a reduced (decreased) grasping force  $F_{2,grasp} > F_{1,gripper}$ .

Further tests will show the reliability of this innovative stroke enhancement adapter. Its shape will be optimized in the next design phase. Another further study direction concerns the coverage of the

fingers of this stroke enhancement adapter, which in the new configuration are responsible for the grasping action, with adhesive strips increasing the coefficient of friction between the grasped object and the fingers of the stroke enhancement adapter attached to the original gripper.



*This work was supported by a grant of the Romanian Ministry of Research and Innovation, CCCDI – UEFISCDI, project number PN-III-P1-1.2-PCCDI-2017-0086 / contract no. 22 PCCDI/2018, within PNCDI III.*

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**Assessment of the Effect of Service Learning in Introductory  
Physics on Students Learning and Critical Thinking**

Course-related Service Learning Project: “Physics of the Car Accident: Building a Safe Campus by Solving Physics Problem” was developed and implemented into an existing introductory physics course (Physics for Scientists and Engineers I, PHY 2048) and is focused on analyzing the Physics of the car accident. The project was supported by UCF Police Department, UCF Office of Service Learning, and Faculty Center for Teaching and Learning. The project pursues the double role: to show the students how the law of physics can help them to build a safer campus and to stimulate their interest in study physics by bringing it closer to everyday life.

The project is integrated to meet pre-defined course objectives. In other words, the service activity is fully integrated and designed to facilitate a course identified learning goals, as opposed to being only an add-on activity.

The development of this active engagement curricula based on the constructive model of student thinking and learning allows diversity in approach to suit student/instructor styles, provide data base for assessment of comparative gains in student learning, and same time help address the specific issue – to improve the safety of young community members driving skills.

The objectives of the project are:

- To integrate theory, problem-solving and experiments in mechanics course with accent on car motion related topics;
- To optimize student engagement (by fostering collaborative learning, providing immediate feedback, adapting activities to students’ state of knowledge, and shifting the focus of control from teacher to students);
- To optimize integration of technology into the physics curriculum by using the active in-class demonstrations, animated figures, student’s presentation posted on you tube, etc.

An important aspect that sets course-related Service Learning apart from simple service is that participants are expected to learn as much from reflecting on their service as they do from performing the actual activity in the class. Reflection often includes student-to-student discussions, journaling, or writing a report/paper describing the impacts of the service activity.

For this project we conduct an assessment study in which the progress of the project attendees was compared to a control group from the same class section of the previous semester.

Results from the pre- and post-tests shows that there is a correlation between students' interest in the subject matter and their grasp and retention of the physics concept. One of the main goals of the physics course, and the main motivation for the creation of alternative curricula, such as service learning approach, is to increase the science literacy of the students graduating from the university. To this end, the course appears to reach the goal. A student understanding of the role of the Physics in everyday life has improved through the course. Student's attitude toward science has also improved greatly. This is evident from the large improvement of confidence rankings from pre- to post-test.



**Marwa Elnady**

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**Effect of PP Grafted p-Hydroxy-N- Phenyl Maleimide  
Comptabilizer and Organoclay Percent on the Properties of  
Polypropylene/Organoclay Nanocomposites**

Polypropylene /clay nanocomposites have been used extensively in a wide range of applications due to their enhanced properties compared to the properties of both the polypropylene and the clay each alone. The degree of enhancement in their properties depends on the extent to which the polymer and the clay are compatible with each other. In the present work the problem of incompatibility between polypropylene and natural clay has been overcome by using PP grafted p-hydroxy-N-phenyl maleimide(PP-g-pHPMA) as a comptabilizer and clay that has been organically modified using hexadecyltrimethyl ammonium bromide surfactant in the polymer nanocomposites synthesis process. The nanocomposites were synthesized by melt reactive extrusion in a twin screw extruder. Two series have been prepared; one in presence of comptabilizer (fixed percent 3%); the other one in absence of comptabilizer and the amount of added organoclay is varied in both series from 1%wt up to 7%wt. The effect of the comptabilizer and the organoclay percent have been studied using X-ray Diffraction Analysis(XRD), Melt Flow Index measurements(MFI), Thermogravemetric Analysis(TGA), Differential Scanning Calorimetry(DSC), Dynamic Mechanical Analysis(DMA), Scanning Electron Microscope(SEM), Gas Transmission Rate (GTR) and Water Vapor Transmission Rate measurements (WVTR). The XRD diffractograms suggests the exfoliation of the prepared nanocomposites. The melt flow index results shows a great increase in the value of the MFI by increasing the organoclay content and the increase is higher in the presence of comptabilizer. The TGA results shows that both the presence of comptabilizer and the organoclay content enhances the thermal stability of the formed nanocomposites. It was found that both the

comptabilizer and the organoclay content have an impact on the barrier properties.

**Aymen Elsheikh**

Instructional Assistant Professor, Texas A&M University at Qatar, Qatar

**STEAM Education at an American Branch Campus in Qatar**

Many researchers argue for the importance of using STEAM skills, which include arts activities, such as visual, aural, verbal, and somatic thinking, to aid in the development of students' creativity and imagination (Babaci-Wilhite, 2019). Therefore, the purpose of this presentation is to report on the STEAM initiative at Texas A&M University at Qatar (TAMUQ) and its role in developing such skills. The goal of the initiative is to integrate the arts and design skills into the STEM curriculum offered at the university. It also aims to raise awareness about and shows the importance and relevance of the arts to a STEM-based education and research (Bickham, 2016) in a transnational education setting. TAMUQ is a US branch campus of A&M flagship campus in Texas and is housed in Qatar Foundation's Education City in Qatar. The Education City is home to six American branch campuses, a British university, a French university, and a Qatari university and has a student body which hails from over 50 countries. Each university offers a different type of specialization. TAMUQ is an engineering university where students major in one of four engineering programs. The university also provides instruction in science, mathematics, liberal arts through its science and liberal arts programs and the curriculum offered in Qatar is similar to that of the main campus' in College Station, Texas. As the liberal arts program is committed to providing a state-of-the-art instruction in the humanities and social sciences to engineering students, it sought the integration of the Arts in the STEM-based curriculum through its STEAM initiative which was established in 2014.

After offering a brief background about Texas A&M University at Qatar, the STEAM initiative, and the relevant literature on STEAM education, the presenter will share, using text and visuals, the different learning opportunities the STEAM initiative afforded to the students, which include activities inside and outside of the classroom. The liberal arts faculty encouraged their engineering students to use research, communication, and critical thinking skills in their technology and engineering projects. The initiative then provided the students a platform to share their projects with a wider audience through the organization of a university-wide STEAM showcase twice a year. The students' projects featured in the showcases included poster presentations, drawings, prototypes, and videos/movies. The importance of this learning opportunity lies in the students' realization that these are important skills to have not only for the workplace but also to develop as an individual. The presentation concludes with highlighting the challenges of the

STEAM initiative and inviting the participants to reflect and share their own experiences with STEAM education. It will also outline implications for future research and professional development in an era of globalization and hegemonic transnational education discourses.

**ChaKaria Hunter**

Graduate Student, San Jose State University, USA

&

**Nikos Mourtos**

Professor, San Jose State University, USA

## **Design of a New Generation Supersonic Transport Aircraft**

This paper presents the preliminary design of a new generation, 150-passenger, Mach 3, supersonic transport aircraft. A higher cruise Mach is chosen (Mach 3, compared to Mach 2 for the Concorde and the Tupolev 144) to ensure a more efficient cruise, as the drag coefficient peaks at Mach 1 and drops at supersonic speeds. The results show that the proposed payload and cruise speed can be met with a takeoff weight of 352,000 lbs (159,665 kg), while providing a range of 4,534 n.mi (8,397 km). Currently FAA and ICAO still restrict supersonic flights over land due to the disturbance caused by sonic boom. Although maintenance and safety issues played a role, these flight restrictions, along with the high operating cost associated with supersonic flight, were the main reasons for the retirement of the only two available supersonic transport aircraft. This project proposes a new supersonic transport aircraft design with a low boom, which will solve both problems at the same time. Firstly, a low boom design will reduce the environmental impact of the aircraft, allowing thus operations over land. This will increase airline flexibility, while planning supersonic routes around the world. Secondly, a low boom design will reduce drag, reducing thus a major component of the operating cost of the aircraft, most of which comes from the cost of the fuel. In addition to reducing the environmental impact, the proposed design is intended to make a supersonic transport more profitable for airlines.

**Adrian Ionescu**  
Professor, Wagner College, USA

## **Polynomial Interpolation and Some New Autonomous Numerical Methods**

This work is an extension of one of my previous papers, in which we have introduced new C software for autonomous ordinary differential equation initial-value problems:

$$\begin{aligned}y_0 &= f(y); y \in \mathbb{R}^n; \\ y(x_0) &= y_0; x_0 \in \mathbb{R}; y_0 \in \mathbb{R}^n;\end{aligned}$$

which implements new Runge-Kutta methods.

The novel feature of this approach is the replacement of evaluations of  $f$  by approximations or evaluations of  $f_y$ . The advantage of this new method lies in the fact that fewer evaluations of  $f$  are required than in the standard Runge-Kutta methods and, usually,  $f_y$  can be approximated to the desired accuracy with very little arithmetic. In effect, the new methods can be thought as multi-step Runge-Kutta methods.

In this paper, we introduce some new Goeken-Johnson Interpolation methods using polynomial interpolation, and we compare the classical Runge-Kutta methods of orders 3, 4 and 5, and the corresponding new Goeken-Johnson methods using both  $f_y$  and approximations of  $f_y$ . We also present numerical results of this comparison. These results (for performance and accuracy) indicate that the new methods are at least comparable if not better than the classical methods.

**Royd Johansen**

MSc Student, San Jose State University, USA

&

**Nikos Mourtos**

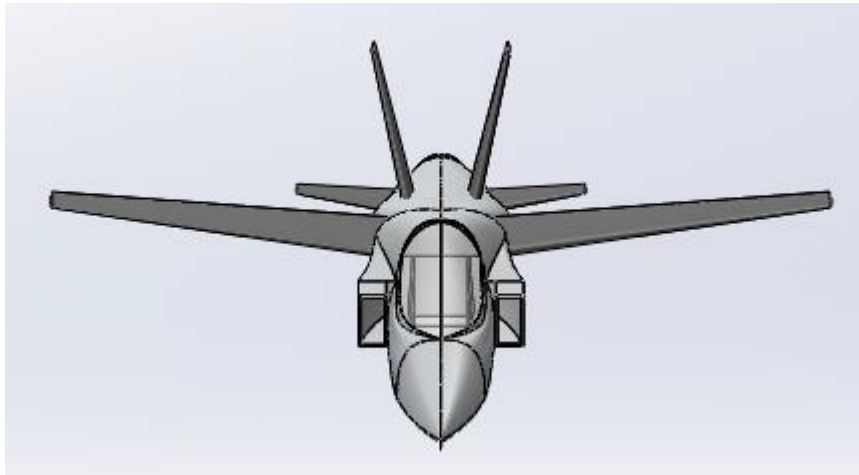
Professor, San Jose State University, USA

## **Aircraft Dynamic Analysis for an Advanced Military Trainer Conceptual Design**

In 2003 the United States Air Force (USAF) began developing requirements for a new aircraft program called the T-X program. The purpose of the T-X program was to replace the existing advanced trainer, the T-38 Talon, and upgrade the current advanced flight program to meet the demands of the USAF's modern and future aircraft. The T-38 is an aging supersonic advanced trainer developed in the 1950s, that cannot meet the USAF's demands as an advanced trainer. Due to budget constraints and other higher priority programs, the official request for formal T-X program proposals from the aerospace industry didn't occur until 2016. Top aerospace companies planning to submit proposal were Boeing/Saab, Lockheed Martin/Korean Aerospace Industries, Northrop Grumman, Leonardo, and Sierra Nevada Corporation. Ultimately the decision came down to the partnerships of Boeing/Saab and LM/KAI. At the end of September 2018, the USAF awarded the T-X program contract to the Boeing-Saab partnership.

In August 2018, a conceptual aircraft design project began based off the T-X program requirements for an advanced military trainer (AMT). The design process focused on a top-level design aspect, that followed the classic aircraft design process developed by J. Roskam's *Airplane Design*. The design process covered: configuration selection, weight sizing, performance sizing, fuselage design, wing design, empennage design, landing gear design, Class I weight & balance, static longitudinal & directional stability, and drag polars. This initial conceptual design is being used to explore more advanced topics, such as: supersonic area rule, V-n diagrams, Class II weight & balance, moments & products of inertia, cost estimation, and potentially more.

The work to be presented for the conference focuses on the dynamic response analysis of the AMT in the longitudinal and the lateral-directional modes. The longitudinal analysis is focused on the short-period and phugoid modes. The short-period mode is generally a heavily damped angle of attack oscillation. The phugoid mode is a long period oscillation with changes in speed, altitude, and pitch angle. The lateral-directional analysis is focused on the dutch-roll modes. The dutch-roll mode is a couple droll and yaw motion. Such analysis is used to develop control laws for augmented control systems, such as fly-by-wire.





**Andreas Karatsolis**

Associate Director of Writing, Rhetoric and Professional Communication,  
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**Integrating Communication and STEM through Stasis Theory  
at MIT**

Over the past twenty years in the United States, most Science and Engineering programs have taken steps to incorporate communication courses in their curriculum, driven either by accreditation requirements (e.g. ABET) or by alumni surveys in which graduates typically assert the importance of communication for advanced participation in the field. Within this context, courses on Scientific and Engineering Communication have been developed, either in-house, by the disciplinary faculty drawing on best practices in their field, or by English and/or Technical Writing faculty in the institution. In both models, however, the instruction students receive treats communication as an activity which follows the scientific or engineering work, and is aimed at making the content of the work accessible and effectively presented to multiple audiences. Yet, we know from research in disciplinary communication (Winsor 2013, Poe et al 2013) that the effective formulation of a disciplinary scientific argument relies on understanding both of the disciplinary content, as well as the rhetorical frameworks used to formulate and communicate the argument.

This presentation reports on an innovative approach to integrating communication within disciplinary STEM courses, using a rhetorical framework for instruction, practice and feedback. Using examples from an advanced graduate level seminar on Aero-Astro and an undergraduate lab subject in Materials Science and Engineering at MIT, we discuss an instructional model which is based a contemporary reformulation of Stasis Theory, both as a heuristic and an analytical tool. This framework allows us to help students not only formulate audience-appropriate research questions, but also have a clear, disciplinary-based path to inform the progression of their argument. Using analyses of student performances (both written texts and oral presentations), we intend to provide evidence of the effectiveness of integrating this model into STEM curricula in higher education. Our larger goal is to argue for the need to bring such integrated models into STEM classrooms so that students can be enculturated in the disciplinary reasoning and communication practices of their field.

**Eunyoung Kim**

Associate Professor, Japan Advanced Institute of Science and Technology,  
Japan

## **STEAM Education in the Context of the Educational Innovations in Graduate Schools**

The educators in higher education are facing several challenges due to diverse changes in the social systems that support the institutions. In addition, learning styles have changed drastically from generation to generation, and it is required to innovate pedagogical approaches. In this regards, numbers of graduate schools have launched educational program including STEAM education to foster the creative leaders of our future.

Recently, there have been numbers of research regarding STEAM education, however there are not enough research on STEAM education for the graduate school level education. Beside the STEAM education, higher education institutes have been trying a numbers of educational program such as CDIO in Engineering school, entrepreneurship education in business school, design workshop program in multidisciplinary schools and numerous programs regarding the initiative to innovate the education in universities and graduate schools.

This study is to review the existing STEAM education and its similar programs in higher education, analyze the content of each type of program through building a framework that include the perspective of both faculty and students, and propose the future direction for STEAM education.

To review the educational programs in graduate schools, this study compares the educational system among Asia, Europe, and the USA, to understand how the STEAM education or similar kind of programs have been developed. In addition, we list up the current projects regarding the STEAM education in the world-class graduate schools, e.g. the STEAM networks in the USA, CDIO network initiated by MIT and Scandinavian countries, and several multidisciplinary educational program for enhancing creativity and innovation skills. As this area is relatively newer than the fields of the study where the participating faculties used to belong to, moreover, they are from such a diverse fields, there is an increasing need of highlighting the distinctions and similarities among various educational programs.

By reviewing the related projects and educational programs, we can position the STEAM education in the context of the educational innovations in graduate schools. Also we can give a set of dimensions to build a framework that can be utilized to describe and compare the existing educational programs developed for innovating the education in graduate school. Finally, this study will help to explain how to identify the

opportunities for directing the future STEAM education that balances the needs among society, faculty and our future leaders - students.

**Attila Kovari**

Associate Professor, Head of Department, University of Dunaujvaros,  
Hungary

## **Education Perspectives of Human-Computer Interfaces**

Modern computer interfaces are becoming more and more common in engineering studies and applications. In the development of these technologies the human-computer interaction is also greatly evolving. Some typical areas of the developments are brain-computer interfaces, eye-tracking, gesture control systems or even virtual 3D, extended reality. Human-computer interfaces also could support the education and learning process in many approaches. The paper presents, review and analyze the possibilities of this topic, the results of some related researches and present the new research possibilities.

**Ahmed Lakhssassi**

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**Multi-Heat Sources Silicon-Die Thermal Monitoring Using  
Embedded Sensor Cells Unit**

Nowadays, real-time thermal monitoring is essential in integrated circuit (IC) and VLSI chip which are a multilayer structure and a stack of different materials. The evolution of the integrated circuits industry (IC) during the decade has been so rapid that it is possible to integrate complex systems on a single chip (SOC, system on Chip). This trend towards increasingly high levels of integration is driven by the need for increasingly efficient systems and thus dissipating enormous power densities. Currently researchers have already designed an algorithm for detecting thermal peaks in the case of a single heat source based on the GDS (Gradient Direction Sensors) methodology. However, this does not solve the problem of thermal peaks monitoring in LAIC (Large Area Integrated Circuits) circuits. In this paper we present an algorithmic and the experimental result of multi-sources silicon-die thermal monitoring method using embedded sensor cells unit. The methodology that has been used is based on the generalized GDS methodology for the case of multiple heat sources. The test results of a configuration of embedded four (4) GDS sensor cells unit has been proposed for the detection of thermal peaks in the case of multiple sources. Our results show that our algorithmic solution gives a satisfactory thermal peak prediction with less than 1.2% error.

**Adam Lantos**

Postgraduate Student, The University of Edinburgh, Scotland, UK

&

**Konstantinos Mouloupoulos**

Associate Professor, University of Cyprus, Cyprus

## **Topology in Modern Solid State Physics: From Topological Insulators to Weyl Semimetals**

Topological materials is one of the hottest fields in the wide arena of solid state physics. Even though the field has gone through various 'revolutions', it is still bombarded by a seemingly endless stream of important new discoveries that offer insight on the fundamentals of it.

These exotic materials have their properties deeply rooted in ideas of topology, hence the talk will naturally begin from topological ideas, mostly in the context of the Berry phase, which is a fundamental ingredient that was added to the basic theory of Quantum Mechanics many years after the latter was formed by its famous fathers.

The talk will then move on to Topological Insulators, which is the first class of topological materials discovered in Nature. The topological invariants that described them will be presented. These include the Chern number and the  $Z_2$  index, both of which have different areas of applicability, depending on the (effective/approximate) dimension of the material and its symmetry properties. Famous site-models will be presented, which have played a catalytic role in the development of the field and were realized as models describing real, experimentally discovered topological insulators. Such site-models include the Haldane model and Kane-Mele model, both of which have been essential in the theoretical study of graphene.

After being done with Topological Insulators, the talk will proceed to the more modern and recently-discovered topological materials called Weyl semimetals. This section will be almost entirely driven by the now-famous Burkov-Balents model in order to showcase, by example, the unique properties of these exotic materials. Recent experimental observations of these materials will be briefly mentioned.

The talk will conclude with a swift presentation of some of the most recent theoretical and experimental advancements of this booming field.

**Steven Le Corre**  
Professor, University of Nantes, France

## **Residual Stresses Prediction in Composite Materials Manufacturing: A Multiscale Combined Experimental and Numerical Approach**

Due to their outstanding specific mechanical properties, composite materials have received a growing interest during the last decades, in particular in the industrial sectors of transportation. One particular feature of those materials is that the material and the part are created at the same time, so that the fabrication processes involve coupled mechanical, thermal and chemical evolutions, as it is the case for thermoset composites. The mechanical state of any produced part is therefore strongly dependent on the thermal history that systematically results in residual stresses and possibly in shape distortions with respect to the initially expected design. This key issue of the composite manufacturing processes has been paid a lot of interest along years, and many models exist in the field. Nevertheless, due to the difficulty of a proper identification of mechanical changes during curing, no one of them is really satisfactory at this day.

In this work, an experimental device called PVT-HADDOC was developed in order to measure anisotropic shape changes of thermosetting composites under homogeneous thermal and mechanical conditions, all over a curing stage, from the liquid state to the solid state during heating and/or cooling steps (200°C, 10bars, +/- 5 K.min<sup>-1</sup>). This device also enables to measure the heat flux between the mold and the sample which provides the degree of cure and the dimensional variations simultaneously. Results on two thermosetting composites are presented, one on a high performance SMC and the other on an aeronautic unidirectional carbon/epoxy. Anisotropic CTE and shrinkage tensors are shown to be obtained with a reasonable precision.

On the other hand, a multiscale approach was developed. It is based on the theoretical framework of periodic homogenization with multiple scale asymptotic expansions which was derive here for the coupled chemical, thermal and mechanical problem. It was then applied to the case of a unidirectional composite. The compressive behavior of the matrix was measured from advanced PVT $\alpha$  measurements realized in our lab whereas its deviatoric behavior makes use of one thermoelastic model of the literature. Homogenization predictions, computed in a 3D FEM code, and experimental measurement are finally in excellent agreement for the prediction of the anisotropic dimensional variations of the composite during its curing cycle.

**Hussein Motaweh**

Professor, Damanhour University, Egypt

&

**Marwa Nabil**

Associate Professor, Advanced Technology and New Materials Research  
Institute, Egypt

## **Porous Silica as a Master Material in Various Applications**

In this study, the production of different architectures of porous silica is shown, using simple and inexpensive alkali chemical technique. The chemical, physical and morphological properties are the master factors, which produce a variety of applications. It has been decided the importance degree of the porous spherical shape; as one of the most important architectures, that assist the dyes adsorption process in various industrial fields as (foods, pharmaceuticals industries, and the textile industry).

As it increases the breadth of the surface area of the material and it can also be used as thermal insulation due to increased electrical resistance and thermal material as well as chemical stability. Thus, we demonstrated the importance of devising different properties of the material for reuse in different applications in many applied fields. Therefore, the study reviewed many sizes and shapes of porous silica in different buildings, which opens the way for us to use in new applications.



3<sup>rd</sup> Annual International Conference on Mechanical Engineering, 22-25 July 2019, Athens, Greece:  
Abstract Book

**Nikos J. Mourtos**

Professor & Chair, Aerospace Engineering, San Jose State University, USA

**The Boeing 737 Max:  
A Systems Approach to Analyzing what Went Wrong**

**Nicolas Saba**

Associate Professor, University of Balamand, Lebanon

## **Analysis and Modification of the Tailoring Method in Hot Stamping Processes**

The realization of ultra-high strength properties and, at the same time, improved structural weight could be achieved through different tailoring routes such as: Tailor-Rolling, Tailor-Welding, and differential thermo-mechanical processes. The use of these techniques in automotive industry aims in improving the energy efficiency of car body structures including, in addition to the obvious aspect of fuel consumption and emissions, an ultra-high level of passenger safety [1]. In this context, a coupled thermo-mechanical simulation is conducted aiming in investigating and improving the used tailoring strategies in the press hardening process. This results in production of structural components (e.g. B-Pillar) with final mechanical properties adapted to the complex loading profile as a result of different crash situations. For this purpose, a complex differential microstructural distribution must be realized through adaptation of differential cooling strategy using diverse die materials with different thermal properties.

**Hemchandra Shertukde**  
Professor, University of Hartford, USA

## **Improvements in the REVOLT Pure Electric Drag Racer by GREEN 707 Club**

A range test of REVOLT-EV was performed using the EVs current, racing-oriented tune conditions. This range test yielded an experimental range of 19.3 miles from a full charge. This range is under the conditions of general city driving with constant powering of the controller, water pump, and brake vacuum. Powering of the truck while it was not moving was ensured to be at a minimum to further show the accuracy of the test. This range is relatively low; however, it is a solid benchmark for further software tuning to increase range. The battery configuration is a sum of 12 kWh, which yields a range of 1.608 miles per kilowatt-hour. We do believe that altering the tune to one with a more conservative total power draw should increase this range the team's personal goal of approximately 2 miles per kWh. While it is not a lot of range, the ability to know how far the vehicle can go without charging means that for local events, the truck will not need to be transported using a trailer. For example, we recently contemplate bringing the truck to local car shows to demonstrate its efficacy.

In addition, the GREEN 707 club, the possibility of the truck being painted in the coming year. Hopefully, advertising the truck to other EV forums and giving a updated paint job will make it stand out and attract more attention to the club after the two important World records achieved by the REVOLT over a decade of fine tuning in its performance criteria as a unique EV suitable for drag racing. In April of 2018 under my guidance a group of students won the 'Inter Collegiate Business Plan (BP) Competition' for the 'Best Consumer Product' award. A cash prize was used to form a new Electric Vehicle (EV) Inc. and is registered in USA.

**Muthuramalingam Thangaraj**

Associate Professor, SRM Institute of Science and Technology, India

&

**Vasanth Swaminathan**

Associate Professor, SRM Institute of Science and Technology, India

**Multi Criteria Decision Making of Power Diode based  
Process Parameters in Laser Beam Machining Using Taguchi-  
DEAR Methodology**

Conventional technology for leather processing comprises leather cutting which operates at slower speeds, less in quality and involves high manpower resources. As a result it drastically restrains the development of the leather industry. Due to small size and low power consumption, diode lasers can process leather rapidly, efficiently and continuously. In the present work, an attempt has been made to analyze the machinability of cow leather using 445nm blue diode based laser beam machining (LBM) process. Since the process related with more than one performance measure, it is essential to establish the multiple response decision making for optimizing the process parameters in this process. Taguchi's L<sub>25</sub> orthogonal array was used to design experimental trials with different levels of input parameters such as frequency, amplitude, duty cycle, standoff distance and cutting speed. Taguchi - Data Envelopment Analysis based Ranking methodology has been used to enhance the performance measures such as geometrical inaccuracy and carbonization in the present study.

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## **The Benefits of Fuel Additives Used in Internal Combustion Engines**

The invention and use of four stroke internal combustion engines was after the mid of the 1800s. Internal combustion engines are used to transportation vehicles such as motorcycle, car, truck, boat, ship, locomotive and airplane. Initially the physical properties of pure or neat fuels were considered sufficient for use in engines, but with the increase in the number of vehicles and its usage rate and the use of the vehicles in a wide geography required the improvement of the fuels. Because of this, fuel additives have been evolved in the since 1920s to enhance fuel properties. Additives are chemical compounds that mixed with fuel. Thanks to the additives so the properties of virgin fuels improve that cannot be attained by the way of the refining processes. Fuel additives used as decreasing engine wear, failures, exhaust emissions, fuel consumption and deposits, improving combustion efficiency, engine power output and also better running in cold weather conditions. Treat levels of additives may vary depend on the refinery, the fuel distributor, the products, and the type of additive used. It may also vary seasonally and regionally. On the other hand, the amount of additives is in a broad-spectrum between 1-1000 mg/kg related to the fuel types and additives used. Especially, due to exhaust pollutant restriction and other reasons that mentioned above, using fuel additive is growing sector in the world.

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## **An Elaboration on the Interface between STEM and Art Searching for Convergences**

The STEAM movement steps up by including the 'A' for arts into STEM (science, technology, engineering, and maths) education. STEAM promotes curiosity (asking questions), communication (creating answers, designing solutions) and artistic skills across the transdisciplinary of disciplines. STEAM focuses not just on making it interesting, but on really achieving engagement, relevance, innovation, and real-world learnings.

This paper aims to reflect on the intersection between STEM and Arts to elaborate some additional coincidences beyond the few that usually are advocated (questioning, creativity, design and communication). Further, some exemplary artworks are taken together to illustrate these coincidental aspects and the power of Art to plastically impact on STEM learning.

The starting point of the elaboration is the conceptualization on the specific traits of STEM, and specially science, as a way of knowing, through the 3-world/NoS&T (nature of science and technology) model and its graded taxonomy that develops some strands and topics. First, science traits are classified in two broad strands: epistemic-cognitive and social-institutional. The epistemic and cognitive strand involves the definitions and relationships of science and technology and the epistemic traits on the nature of the scientific and technological knowledge. The social-institutional strand involves the external and internal sociology of science; the external sociology involves the topics about the influences between society and the science / technology system, and the triadic science-technology-society relationships; the internal sociology of science involves the characteristics of scientists, the social construction of the scientific and technological knowledge.

The former taxonomy is used as a methodological tool to guide the analysis and reflection on the shared traits between art and STEM. The results of the comparative analysis between STEM and art are summarized through the following convergent aspects for each of the big strands.

*Epistemic-cognitive*

- Posing big questions about the world
- Observation, especially visual perception
- Imagination and creativity
- Change along time
- Science and art share technology
- Experimental focus of activities
- Artworks account for scientific and technological knowledge

*Social-institutional*

- Historical dimension
- Importance of commissioned work
- Science and technology provide themes for artists
- Interactions with society
- Influences on/from society
- Science and art education share goals and competences of curriculum
- Human enterprises
- Role of genial individualities
- Cooperation and team work
- Creation of professional organizations
- Norms and values
- Social construction

The in-depth justification, explanation and consequences of the former elaboration items will be further developed at the Symposium.

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## **Real-Time Body Temperature and Heart Rate Monitoring System for Classification of Physiological Response Patterns Using Wearable Sensor and Machine Learning Technology**

**Introduction:** A subset of mobile devices allows recording of health data. This facilitates continuous monitoring and analysis of personal vital signs and opens the potential for automated anomaly detection outside of clinical environments. An unobtrusive day-to-day system could be used to detect anomalies caused by disease onset or to improve quality of life for chronically ill patients. But, interpretation of sensor health data is challenging. Physiological response patterns (PRP) depend on demographic factors and are based on activities, diseases and the environmental context. Therefore, PRPs cannot be described in general terms. However, machine learning algorithms (MLA) could be used to classify individual PRPs as either normal or abnormal.

**Objectives:** The objectives were to develop an architectural concept of a real-time monitoring and classification system based on the vital signs heart rate and body temperature and to implement it as a proof-of-concept prototype. The prototype should then be used to assess if MLAs can classify a tendency change of vital sign response patterns as either physiologically normal or abnormal.

**Methodology:** The architectural concept and the prototype were developed using a Cosinuss<sup>®</sup> One sensor, an Android application and a Python server. The selected MLAs for anomaly detection are Local Outlier Factor, Isolation Forest, One-Class Support Vector Machine and Autoencoder. A 72 hour-long data sample was recorded for assessment of these algorithms (N = 1). Since generation of irregular health data is not possible at the push of a button, the measurements during the activities sport, metro and eating were regarded as artificial anomalies. All the remaining measurements were considered as normal. The MLAs were finally evaluated using confusion matrices to calculate the metrics accuracy, sensitivity and specificity.

**Results:** The MLAs performed in all cases with an accuracy higher than 80%. With the exception of the Isolation Forest, specificity was higher than sensitivity. All algorithms showed a specificity higher than 88%. For sensitivity the MLAs reached results better than 76%. The best overall



results were achieved using the One-Class Support Vector Machine with 89.94% accuracy, 87.80% sensitivity and 92.07% specificity.

**Conclusion:** We introduce an approach for automated classification of PRPs based on mobile sensor data. The prototype shows that different selected activities can be classified as irregular using MLAs. Further research is needed to assess if also irregularities caused by diseases can be detected with high accuracy, sensitivity and specificity.

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## **Structural Design and Dynamic Analysis of a New Drill Floor Robot**

With the continuous development of automation technology in the global oil industry, intelligence has shown an inevitable trend. The intelligence of the drill equipment in the oil industry is still in the initial stage. Based on the analysis of the current status of the world's oil drill industry, this paper discusses the whole process of drilling operation and its existing problems. It proposes a new type of drill floor robot that integrates assistance and carry (assistance for long pipes, carry for the short pipes), and the conversion of these functions can be achieved by replacing the end effector. This paper has done the following work: Use this drill floor robot as the research object, creating a robot coordinate system using the link parameter method. Completing kinematic analysis, including kinematics positive solutions and kinematics inverse solutions. Finishing the dynamics analysis to analyze the velocity and acceleration of the robot components and the Newton-Eulerian dynamic recursive formula. Establishing the Lagrange equations to describe the dynamic equations of the robot system to optimize dynamics algorithm, authentication algorithm optimization feasibility. Using MATLAB Robotics Toolbox to verify the correctness of design and analysis of the new drill floor robot. The paper provide a new idea for intelligent drilling operations, thus promoting the rapid development of the drilling industry.