Abstract Book

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Areg Mickaelian

NAS RA V. Ambartsumian Byurakan Astrophysical Observatory (BAO)
Armenian Astronomical Society (ArAS)
IAU SWCA Regional Office of Astronomy for Development (ROAD)
Armenian Virtual Observatory (ArVO)

Laser Ablation Propulsion: Basic Research and Application to Space Debris Problem

The leading role of Astronomy in the development of inter- and multi- disciplinary sciences between Astronomy and all other natural sciences is explained in providing vast amount of new data from Space, namely data useful for the expansion of our knowledge that before was based only on the information collected on the Earth, in fact a tiny part of the studied Universe. This way Astronomy also becomes the key science for Big Data collection, storage, reduction, analysis and interpretation. All these data become basis for development of Astronomy related interdisciplinary sciences, such as Astrophysics, Astrochemistry, Astrobiology, Planetary Science or Planetology (Astrogeology), Astroinformatics, Archaeoastronomy, etc. We will review the current situation with inter- and multi- disciplinary sciences and the leading role of Astronomy in their formation and development.

Biography:

Dr. Areg Mickaelian was born on 22 June 1962 in Yerevan. In 1984, he graduated from YSU with a specialization in astrophysics. He started working at the Byurakan Astrophysical Observatory in 1986. He obtained his Ph.D. degree in 1994 and was the Sci. Secretary of BAO in 1994-2001. At present, A. Mickaelian is the Head of the Armenian Virtual Observatory (ArVO) research group (since 2005), and a Leading Research Associate (since 2007). He is the founding President of ArAS (Co-President, since 2002). Since 2001 he has been lecturing at the YSU Physics Faculty, Chair of Astrophysics. Since 2002, he is the PI of the Digitized First Byurakan Survey (DFBS) project, since 2005-founding Project Manager of ArVO, since 2006 - founding Chair of the Byurakan International Summer Schools (BISS), since 2009 Sci. Secretary of Viktor Ambartsumian International Prize Steering Committee.

Ehan Sabah Shukri Askari

Middle Technical University (MTU), Iraq

Temperature Uniformity Analysis in Annular Passages with Swirl Flow

Uniform distribution plays an important role in engineering applications. Numerous studies were carried out to investigate uniformity such as heat transfer uniformity, temperature uniformity, and velocity uniformity. Uniformity temperature (γ) is essential for combustion chambers. In a combustion chamber, good mixing is very important for a high burning rate. The attainment of satisfying temperature distribution in the exhaust gases is very dependent on the degree of combustion mixing. As long as temperature distribution enhancement has an important role to achieve good mixing, different enhancement methods have been developed by increasing the turbulence intensity. A swirl flow generator is one of the fundamental methods that are used to enhance the distribution rate. Swirl generators such as helical screw-tapes, twist tapes, dimples, fins, struts, etc. can produce it. These generators create turbulent flow and swirling motion that can force the fluid to move in the direction of the flow and in the radial tangential direction. These inserts are active areas for the researchers to study their effects; hence, they increase the turbulence intensity and have a dominant role in enhancing temperature distribution. Temperature uniformity (γ) was analyzed in the annular passages to indicate how much the distribution of the temperature is at the outlet. The work was achieved by using different geometric models of swirl generators using air as the working fluid.

Biography:

Dr. Ehan Sabah Shukri is working as a lecturer at Middle Technical University (MTU), Baghdad. She was honored that she has been selected for lecturing at the University Technology Baghdad, Department of Mechanical Engineering after she got her Bachelor's Degree in 1984. Lecturing is so rewarding and gave her a sense that she was making the world a better place for her students. Because they are the future and have unlimited value. She earned her master's degree in air-condition engineering from the Mechanical Engineering Department, University Technology Baghdad in 1989. In addition, she obtained her Ph.D.in Thermo Fluid Mechanics from University Technology MARA, UiTM, Malaysia 2016. Research interests include but are not limited to heat transfer enhancement applications in diffusers including swirl flow, and temperature distribution by introducing different concepts of swirl generators fitted with different types of diffusers. She has published various research articles in these areas. Additionally, since 1984, she worked as a lecturer; she has more than 30 years of experience in lecturing mechanical engineering subjects.

Ian Mc Andrew

Embry Riddle Aeronautical University, USA

Cyberpsychology and its relationship to the future of aerospace

The aerospace industry has been dealing with cyber security issues for many years now and this is becoming a core part of the design of any aircraft or system in aviation, including space. This presentation report together several research projects on cyberpsychology and how it relates not only to the general subject area but also now in aviation. This can be from the maintenance aspect of the aircraft up to the core design and those that trying to find ways of causing problems with the design and operation of any aerospace system. It concludes by highlighting that success is made in the areas where more effort is needed to be researched and solutions found that the industry can stay one step ahead of a potential problem.

Biography:

Dr McAndrew is the dean of doctoral programs for Capitol Technology University based just outside Washington DC. He has been supervising research students for over 30 years and has shared more than 60 international conferences. During his time in academia has produced over 80 peer reviewed conference and journal papers in addition to successfully chairing in excess of 150 doctoral students. Dr McAndrew is a recognised researcher and leader in many areas and has published several books and add it takes consultancy over nationally and internationally.

Lars Lewerentz, Ralf Schneider

University of Greifswald, Germany

Modeling of high efficiency multistage plasma thrusters

The high efficiency multistage plasma-thruster (HEMP-T) represents an ion thruster technology that was developed by Thales Deutschland GmbH. It has a dielectric discharge channel and a magnetic field applied by periodic permanent magnets.

The typical length scales in the HEMP-T plasma range from microscopic over mesoscopic to macroscopic. Atomic collisions and surface interactions are representatives for microscopic scales. Mesoscopic interactions appear in the plasma on the Debye length and the gyro radius of particles in the magnetic field. The plume expansion and interaction with the testing vessel walls constitute the macroscopic scales.

For a correct description of both thruster and plume plasma all these scales need to be resolved and modelled kinetically. This is done via an axisymmetric 2D3V Particle-in-Cell (PIC) simulation.

While good qualitative agreement with experimental data is achieved, a better quantitative agreement is necessary to predict thruster performance with numerical models. Then, the possibility arises to predict and optimize thruster designs. This would accelerate the development of HEMP thrusters and save time as well as costs in the process.

Biography:

Lars. Lewerentz, Scientist at the Institute of Physics.

Lars Lewerentz studied physics at the universities of Greifswald and Aberdeen. His research interest include plasma and computational physics. He is interested in the development of Particle-in-Cell models and their application to plasmas including but not limited to ion thruster plasmas.

Zhaoye Qin

Department of Mechanical Engineering, Tsinghua University

Studies on Pyroshock Prediction and Isolation in Aerospace Engineering

Pyrotechnic devices, such as separation nuts and explosive bolts, are widely employed for stage separations, satellite-rocket separations, and appendages actions in aerospace engineering. During separation actions, along with the detonation of explosive, these pyrotechnic devices generate violent mechanical response, namely pyroshock, which tends to damage electronic components sensitive to high-frequency shock, and may even cause flight failures.In this talk, by adopting the explicit dynamic method Hydrocodes, the near-filed pyroshock response caused by the detonation of separation nuts are investigated, and the effects of preload level and explosiveamount onpyroshock response are evaluated. Then, based upon the studies of stress wave transmission in stepped rods, two spacecraft-rocket interface structures for pyroshock isolation, namely isolation hole andinterim segment, are proposed. Both numerical simulations and experiments are carried out to verify the efficiency of the two shock isolation strategies. Finally, the wave propagation characteristics in functionally graded metal foam plates reinforced with graphene platelets and periodic rods are investigated to explore possible applications of new materials and structures to realizepyroshock manipulation in aerospace engineering.

Key words: Pyroshock; shock response spectrum; shock isolation; aerospace engineering

Biography:

Dr. Qin is currently an associate professor at Department of Mechanical Engineering in Tsinghua University, China. He received the B.S. and M.S. degrees in Mechanical Engineering from Northeastern University, China,in 2003 and 2006, respectively, and thePh.D. degree in Mechanical Engineering from Tsinghua University, China,in 2010. He is serving as an Associate Editor of Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science, and an Editorial Board Member of Nanotechnology Reviews. His research interests include structuraldynamics, rotordynamics and condition monitoring, aerospace engineering, nanocomposites, vibration control, and energy harvesting. Recently, he has devoted considerable effort to pyroshock simulation techniques both theoretically and experimentally in aerospace engineering.Dr. Qin has published more than 100 highly cited papers in peer reviewed journals.

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Bo Li

Shanghai Maritime University, China

Adaptive dynamic programming-based tracking control for a quad rotor unmanned aerial vehicle under uncertainties

Anadaptive dynamic programming technique based control schemeis formulated for theoptimal trajectory tracking control problem of a quadrotor unmanned aerial vehicle (UAV) in the presence of uncertainties.The feedforward control methodology is employed firstlyto transform the tracking control problem into the stabilization control problem.To eliminate the impacts exerted on the control performances generated by the uncertainties,two novel terms that can reflect the uncertaintiesare introduced in the index performance functions of the attitude and position error systems respectively.To balance the control performance and the control cost, two newoptimal control policies are proposed, in which two critic neural network architectures are used to replace the traditional actor-critic architectures to obtain the approximatesolutions of the Hamilton-Jacobi-Bellman equations. Moreover, aconstraint existing in mostly previous works is that they cannot avoid using the assumption of the persistent excitation condition. The persistent excitation condition refers to a special matrix cannot be ensured positive definite in an arbitrary time interval.To this end, two novel critic neural network weight update laws are proposed on the basis of adaptive control technique to replace the traditional update laws designed by gradient decent method.The key featureis that the proposed weight update laws canremove the dependence on the persistent excitation conditionand avoid requiring the positive definiteness of the special matrix further.Finally, the tracking errors and the weight approximation errors can be guaranteed to be ultimately uniformly bounded stable through a strict analysis according to theLyapunov method.

Biography:

Dr. Bo LI received the B.Eng. degree in electrical and electronic engineering from the School of Computer and Information Engineering, Henan University, Kaifeng, China, in 2010, the M.Eng. degree in aerospace engineering with specialty in navigation, guidance, and control from the Civil Aviation University of China, Tianjin, China, in 2013, and the Ph.D. degree from the Department of Control Science and Engineering, Harbin Institute of Technology, Harbin, China, in 2016. He is currently an Associate Professor with Shanghai Maritime University, Shanghai, China. He has authored or coauthored more than 40 papers in journals and conferences. His research interests include autonomous control and optimization of unmanned systems, control allocation, fault diagnosis and fault tolerant control, UAV-based ports' monitoring, etc.

Chenglong Ma[1,2], Meiping Wu[1,2] and Dongdong Gu[3]

[1]Jiangsu Province Engineering Research Center of Micro-Nano Additive and Subtractive Manufacturing, Wuxi, 214122, PR China

[2]School of Mechanical Engineering, Jiangnan University, Wuxi, 214122, PR China

[3]College of Material Science and Technology, Nanjing University of Aeronautics and Astronautics, Nanjing, 210016, PR China

A large recoverable strain and good cyclic stability of Laser powder bed fused NiTisuperelastic partsaiming to impact resistant applications in the aerospace field

With the rapid development of 4D printing technologies, NiTi shape memory alloy (SMA), as a typical metal-based intelligent material, has been becoming a hot topic inrelative research fields. Due to unique thermal elastic martensite reversible transformation, NiTi SMAs show shape memory effect and superelasticity that are not available in traditional metal materials. Besides, NiTi SMAs can form a rubber-like hysteresis ring during the loading-unloading process, showing high energy absorption characteristics. Hence, NiTi SMAs become the preferred material for novel vibration-absorbing/impact-resistance components applied in the aerospace field. In past few years, we have devoted ourselves to the investigations on microstructure, phase transformation and superelasticity of laser powder bed fused NiTi-based SMAs. By the tailored LPBF process and optimized aging treatment, a large compressive recoverable strain and good cyclic stability had been achieved. Besides, some novel innovative structures had been further proposed and designed based on the bionic concepts, in order to enhance the energy absorption capacity of the LPBF-fabricated NiTi-based components. These studies can be expected to promote the potential applications in the aerospace field.

Biography:

Chenglong. Ma, Lecturer of School of Mechanical Engineering, Jiangnan University

Dr. Chenglong Ma received a Ph.D. in materials processing technology from Nanjing University of Aeronautics and Astronautics, Nanjing, China, in 2020. He has ever studied in Cardiff University as the recipient of Newton Fund Grant Agreement PhD placement. Since Jan 2021, he has been working as a lecturer in School of Mechanical Engineering, Jiangnan University, Wuxi, China. His research interest includes laser-based additive manufacturing of shape memory alloys, advanced metal matrix composites and bionic materials. He has published more than 30 SCI papers in Virtual Phys. Prototyp.,Mater. Des.,Appl. Surf. Sci.,Mater. Character.,CrystEngCommand so on, and his H-index is 20.

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Javier A. Pérez-Castán*[1], Luis Pérez Sanz[1], Tomislav Radišić[2], Häusler Hermann Ruth Esther[3], Roland Guraly[4], Keiko Moebus[5], Bernd Neumayr[6] and Lars Schmidt[7]

1. *Universidad Politécnica de Madrid, ETSI Aeronáutica y del Espacio*
2. *Faculty of Transport and Traffic Sciences at University of Zagreb*
3. *Zurich University of Applied Sciences (ZHAW), School of Engineering*
4. *Slot Consulting Ltd*
5. *5Skyguide Swiss Air Navigation Services Ltd*
6. *Johannes Kepler University Linz / Institute of Business Informatics – Data & Knowledge Engineering*
7. *Technische Universität Braunschweig, Institute of Flight Guidance*

Risk assessment of using AI-based systems in ATC functions: lessons learned from AISA

Artificial intelligence (AI) is one of the most promising technologies to be implemented in different areas. In particular, air traffic control (ATC) is undergoing a breakthrough with the introduction of artificial intelligence for automation purposes. However, the use of AI in safetycritical systems, which is the control of air traffic, presents several uncertainties that must be solved prior to its implementation. Risk assessment and hazard identification are crucial for safe integration of any system, and AI-based systems are not an exception. The goal of this work is to provide insights on the risk assessment developed for a specific AI-based system for ATC and how the lessons learned can be applied for further research. AISA (Artificial Intelligence Situational Awareness) foundation for advanced automation is a European project that proposes building a foundation for automating some monitoring tasks and constitutes a team with the ATC operators. The risk assessment performs a safety analysis by identifying hazards, analysing them and their risks (based on probability and severity) and providing mitigation measures. The primary risks of distributed human-machine SA are identified and many proposed mitigation measures are related to the implementation of safety requirements during the design phase of the system. 74 hazards were identified and more than 150 mitigation measures were proposed. The main contribution of the developed risk library is that it expands the knowledge of AI hazards for their introduction into the ATC system.

Biography:

Javier Alberto Perez Castan was born in Huesca (Spain). He has got BSc degree from Aeronautical Engineering, MSc degree from Aerospace Engineering and PhD from Aerospace Engineering of Universidad Politecnica de Madrid (UPM). His expertise focuses on aerospace and procedure design, risk assessment and RPAS integration in ATM. Nowadays, Prof. Perez Castan is a researcher and assistant professor in the UPM and belongs to the Navigation Area Research Group (GINA).

Lt. Col. Konrad Wojtowicz

Faculty of Mechatronics, Armament, and Aerospace,Military University of Technology, Warsaw, Poland

Education for Aerospace Industry at the Military University of Technology, Warsaw, Poland

The Faculty of Mechatronics, Armament and Aerospace at the Military University of Technology, Warsaw, Poland offers interdisciplinary technical education in four fields of study: Aeronautics and Astronautics, Mechatronics, Unmanned Vehicles Engineering, and Safety Engineering. The wide scope of the Faculty's research covers needs of the Polish Armed Forces, local governments, and industry. It involves problems including:

- Robotics, mechanics, control theory, automation, microprocessor technique
- Programming and design of mechatronic devices for military and industrial applications
- Digital signal filtering
- The control and processing systems in real time
- Design of microwave devices and signal processors
- A comprehensive experimental study of energetic and ballistic properties of solid propellants
- Research and modeling of internal, external, intermediate and final ballistics
- Numerical study of propagation and the impact of blast waves
- Manufacturing technology of elements produced by powder metallurgy
- Analysis of phenomena in materials subjected to shock loads
- Endurance test of arms, forecasting the state and management the process of operation of technical equipment and systems
- Technical thermodynamics, thermal metrology
- Investigations of thermo-physical properties of materials
- Mathematical modeling of complex heat-mass exchange phenomena
- Material engineering in terms of the thermo-physical properties of materials
- Computer-aided measurement process
- Inverse problem related to estimation of the thermo-physical parameters of solids
- Aerodynamic characteristics of the ground and flying objects
- The dynamics of movement of flying objects
- investigating the effect of icing on the aerodynamic characteristics and flight safety of aircrafts
- Design of aircrafts
- Integrated structural and aerodynamic modeling of aero-elastic load-carrying systems
- Evaluation of strength, durability and safety of damaged structural components
- Study of operating processes of technical systems in terms of their reliability, efficiency and safety
- Modeling dynamics of release of energy and the movement of physically inhomogeneous energetic media for forecasting safety risks.

Biography:

Lt. Col. Konrad Wojtowicz is an assistant professor and researcher at the Faculty of Mechatronics, Armament, and Aerospace of the Military University of Technology, Warsaw, Poland, where he is currently serving as an Associate Dean for Students and International Affairs. He is a former Laboratory of Avionics and Air Armament Head. He has taken part in projects on UAV technology funded by the EU and NATO. He has been a speaker in three ATC projects funded by NATO in the field of UAVs.

He received an M.Sc. degree in mechatronics, aeronautics and astronautics, air armament, and a Ph.D. in mechanical engineering in the area of HIL simulators for UAV mission and control system computers.

He has participated in research on developing an aircraft avionics system and simulation environment. He has been assigned to support military commissions as an expert in the Ministry of Defense and Air Force HQ. He conducts research mainly on avionics software development, software engineering, and simulators.

L. H. Liang

School of Mechanical and Electrical Engineering, Beijing University of Chemical Technology, Beijing, 100029, China

Muti-scale interface mechanical properties between ceramic coatings and metallic substrates

Thermal barrier coatings are widely used in aerospace components, such as engine blades, combustion chamber, seal ring, etc. Although thermal protect effect of thicker ceramic coatings is better, the thicker coatings induce larger interface stress between the coatings and the substrates, and interface fracture is easier besides the more expensive cost. Understanding interface mechanical mechanism is helpful to design. In this talk, multi-scale interface mechanical properties from the atomic scale to the macro scale between ceramic coatings and superalloy substrates will be introduced. Size-dependent interface energy and interface strength were studied based on the thermodynamics of nanomaterials, the molecular dynamics method and tensile tests. Thickness-dependent interface damage of coatings and the effect of residual stress was further discussed by combining with the finite element analysis. The related energy mechanism was revealed.

Biography:

Lihong Liang, Professor.

Dr. Prof. Lihong Liang works in Beijing University of Chemical Technology, China since Jul. 2019. She was graduated from Jilin University in 2003 with Ph.D degree of Materials Science, and once worked in National University of Singapore (2005-2007) and Chinese Academy of Sciences (2003-2005 in Institute of Physics, 2007-2019 in Institute of Mechanics). She is interested in Surface/interface, Micro/nano Mechanics, Thermodynamics, Thermal Conduction, Elastic modulus, Interface Strength and Damage/fracture of advanced coatings and thin films. She published more than 50 SCI papers in Physical Review B, Computational Materials Science, Ceramic International, etc., and the papers were cited by many research groups from different countries.

Lihong Su

School of Mechanical, Materials, Mechatronic and Biomedical Engineering, University of Wollongong, NSW 2500, Australia

Bulk nano-grained Ti-6Al-4V alloy with high strength and superior wear resistance: fabrication and characterizations

Titanium and its alloys have been widely applied in automotive, aerospace, structural and biomedical industries because of their specific physical and mechanical properties, displaying different allotropic phases dependent on the pressure, temperature and chemical alloy compositions. The most widely used titanium alloy is Ti-6Al-4V alloy, which accounts for over half of the worldwide titanium tonnage. In the present study, bulk nano-grained Ti-6Al-4V alloy has been successfully fabricated by high pressure torsion process, which is one of the most popular severe plastic deformation techniques. The influence of high pressure torsion on the microstructure, phase constitution, microhardness and wear resistance of Ti-6Al-4V alloy has been systematically investigated. In comparison with its coarse-grained counterpart, the nano-grained Ti-6Al-4V alloy has remarkably enhanced strength and wear resistance. Additionally, there is no obvious phase transformations observed during plastic deformation of Ti-6Al-4V alloy by high pressure torsion, thus its strength improvement is mainly due to the contributions from the microstructure refinement and dislocation activities.

Biography:

Dr. Lihong Su received her PhD in 2013 in Mechanical Engineering from University of Wollongong, Australia, where she is currently working as a teaching staff and research team leader. She is an internationally active expert in advanced manufacturing. Her research interests include design, manufacturing and characterizingnovelhigh-performance metallic materials and composites for extreme conditions, such as light-weight aluminum and titanium alloys, high-strength steels, and high entropy alloys. She has already established strong collaborations with research institutes, universities and industries from Australia, China, USA, France, and Japan. She has published more than 70 highly cited research papers in peer reviewed journals and delivered more than 10 invited or keynote talks in high-qualified international conferences. She serves as an associate editor and guest editor for several international journals in the field of manufacturing, and she also serves as a co-organizer or co-chair for several international conferences. Additionally, Dr. Su has won several prestigious awards based on her excellent research record, including France-Australia Science Innovation Collaboration (FASIC) fellowship, Japan Society for the Promotion of Science (JSPS) fellowship, and Australian Discovery Early Career Researcher Award (DECRA) fellowship.

Longjun Wang[1], Chi Wai Wong[2] and Yu Zhou[2]

[1]Aircraft Propulsion Laboratory, Ningbo Institute of Technology, Beihang University

[2]Center for Turbulence Control, Harbin Institute of Technology, Shenzhen, China

Development and Applications of Sawtooth Dielectric Barrier Discharge Plasma Actuator

Dielectric barrier discharge plasma actuator had been proved to an effective electrodynamic device in many application cases, such as, lift enhancement, drag reduction, vibration and noise impression, in compressible and incompressible flows. Traditional plasma actuator with linear electrodes normally produced only two-dimensional jet flow. However, some novel plasma actuators with sawtooth, circular, trapezoidal electrodes which induced jet flow and three-dimensional flow structures, were developed recently with aim to extend their operating range. The present work focuses on the development of sawtooth plasma actuator and its application in airfoil flow separation control. Systematic comparisons are made between traditional plasma actuator and sawtooth plasma actuator in induced flow characteristics, power consumption, flow control efficiency under steady and unsteady actuation, and underlying physics for the optimum control cases. The disadvantages of sawtooth plasma actuator over the traditional one also summarized. Finally, the New development trends are introduced briefly.

Biography:

Dr. Longjun Wang received the Ph.D degrees in mechanical engineering from Harbin Institute of Technology, Shenzhen, China, in 2018. From 2019 to 2021, he worked as postdoctor in Center for Turbulence Control, Harbin Institute of Technology, China. His research interest includes the development of novel plasma actuator, flow separation control, bluff body aerodynamics and flow induced vibration and noise. He currently worked as associate researcher in Beihang University, Ningbo, China. He has published 21 SCI journals and got involved in 8 research projects which granted by Shenzhen, Ningbo, Zhejiang and China government. He was awarded as a title of high-level talent by Ningbo government and outstanding young researcher by Beilun government in 2021.

Lori J. Brown

Western Michigan University, College of Aviation

Transforming the Future of Global Aviation Training with Augmented Reality and Spatial Computing

We have seen how Augmented Reality has started to transform aviation and now we can optimize global training with digital tools such as, spatial computing. In spatial computing we can connect digital objects and virtual worlds. In practice, this means an instructor can present a digital version of an aircraft, aircraft system or flight deck to multiple students in different locations around the world at the same time. Students are mirrored as avatars and can walk around the aircraft, learn cockpit procedures, with multiple people in the flight deck just as if they were together in aircraft setting. With spatial computing, you can run a training session from anywhere in the world and educate your workforce in a way that is interactive and engaging. The potential of using 3D graphically rendered content to illustrate objects for the purpose of global aviation training is limitless.

Biography:
Lori Brown is a Professor and Researcher at Western Michigan University, College of Aviation. Her transformational research includes the use of spatial computing and augmented reality in civil aviation. She is currently a researcher for the FAA PEGASAS Center of Excellence dedicated to helping the FAA revolutionize technical training. Her work has been featured internationally at many conferences, books, and journal publications. She is an Airline Transport Pilot and has trained Ab-initio cadet pilots for British Airways, KLM, and UAE, as well as pilots for national and international government agencies. She evaluates military aviation training and occupations for the American Council on Education (ACE). Her dedication and passion for transforming aviation training has earned her several awards.

Osman Adiguzel

Firat University, Department of Physics, Elazig, Turkey

Thermo-mechanical Treatments and Reactions for Reversible Behavior of Shape Memory Alloys

Shape memory alloys take place in class of advanced smart materials with adaptive properties and stimulus response to the external changes. These alloys have the shape reversibility character and capacity of responding to changes in the environment. These alloys have dual characteristics called thermoelasticity and superelasticity, from viewpoint of memory behaviour. Shape memory materials are very important and useful in many interdisciplinary fields from biomedical, medicine, pharmacy, to metallurgy, semiconductor, and many engineering fields and aeronautical industry. This phenomenon is initiated with thermal and mechanical processes on cooling and stressing, and performed thermally on heating and cooling, with which shape of the material cycles between original and deformed shapes in reversible way. Therefore, this behavior can be called Thermoelasticity.

Superelasticity is performed mechanically with stressing and releasing the material at a constant temperature in the parent phase region, shape recovery occurs instantly upon releasing, by exhibiting elastic material behavior. Stress-strain profile exhibit nonlinear behavior in stress-strain diagram, and this behavior refers to energy dissipation. Thermoelasticity is governed by two structural transformations, thermal and stress induced martensitic transformations in crystallographic basis. Thermal induced martensitic transformation occurs on cooling with cooperative movement of atoms by means of lattice invariant shears on {110} - type planes of austenite matrix along with lattice twinning and ordered parent phase structures turn into twinned martensite structures.The twinned structures also turn into detwinned martensite structures by means of strain induced martensitic transformation with stressing the material in low temperature condition.Superelasticity is also result of stress induced transformation and parent phase structures turn into detwinned martensite structure with stressing.

Copper based alloys exhibit this property in metastable β-phase region, which has bcc-based structures. Lattice invariant shears are not uniform in these alloys, and the ordered parent phase structures martensitically undergo the non-conventional complex layered structures on further cooling.

In the present contribution, x-ray diffraction and transmission electron microscopy studies were carried out on copper based CuZnAl and CuAlMn alloys. X-ray diffraction profiles and electron diffraction patterns exhibit super lattice reflections inherited from parent phase due to the displacive character of martensitic transformation. X-ray diffractograms taken in a long-time interval show that diffraction angles and intensities of diffraction peaks change with the aging time at room temperature. This result refers to a new transformation in diffusive manner.

Keywords: Shape memory effect, martensitic transformation, thermoelasticity, superelasticity, lattice twinning and detwinning.

Biography:

O. Adiguzel, Retired Professor

Dr. Adiguzel graduated from Department of Physics, Ankara University, Turkey in 1974 and received PhD- degree from DicleUniversity, Diyarbakir-Turkey. He has studied at Surrey University, Guildford, UK, as a post-doctoral research scientist in 1986-1987, and studied on shape memory alloys. He worked as research assistant, 1975-80, at DicleUniversity and shifted to Firat University, Elazig, Turkey in 1980. He became professor in 1996, and he has been retired on November 28, 2019, due to the age limit of 67, following academic life of 45 years.He published over 80 papers in international and national journals; He joined over 120 conferences and symposia in international and national level as participant, invited speaker or keynote speaker with contributions of oral or poster. He served the program chair or conference chair/co-chair in some of these activities. In particular, he joined in last seven years (2014 - 2020) over 80 conferences as Keynote Speaker and Conference Co-Chair organized by different companies. He supervised 5 PhD-theses and 3 M.Sc.- theses.

Dr. Adiguzel served his directorate of Graduate School of Natural and Applied Sciences, FiratUniversity, in 1999-2004. He received a certificate awarded to him and his experimental group in recognition of significant contribution of 2 patterns to the Powder Diffraction File – Release 2000. The ICDD (International Centre for Diffraction Data) also appreciates cooperation of his group and interest in Powder Diffraction File.

Sidra Aman

University of Haripur, Pakistan

Gold nanoparticles impact on Poiseuille flow of nanofluid passing through a porous mediumin the presence of thermal radiation, thermal diffusionand chemical reaction

Impacts of gold nanoparticles on MHD Poiseuilleflow of nanofluid in a porous medium are studied. Mixed convection is induced due to external pressure gradient and buoyancy force. Additional effects of thermal radiation, chemical reaction and thermal diffusion are also considered. Gold nanoparticles of cylindrical shape are considered in kerosene oil taken as conventional base fluid. However, for comparison, four other types of nanoparticles (silver, copper, alumina, and magnetite) are also considered. The problem is modeled in terms of partial differential equations with suitable boundary conditions and then computed by perturbation technique. Exact expressions for velocity and temperature are obtained. Graphical results are mapped to tackle the physics of the embedded parameters. This study mainly focuses on gold nanoparticles; however, forthe sake of comparison, four other types of nanoparticles namely silver, copper, alumina and magnetite are analyzed for the heat transfer rate. The obtained results show that metals have higher rate of heat transfer than metal oxides. Gold nanoparticles have the highest rate of heat transfer followed by alumina and magnetite. Porosity and magnetic field have opposite effects on velocity.

Biography:

Sidra Aman: University of Haripur, Pakistan "Dr. Sidra Aman obtained her Ph.D(Applied Mathematics) in 2020 from the Universiti Malaysia Pahang (UMP), Malaysia at the age of 29. She started her career working as an Assistant professor at the University of Haripur, Pakistan in 2021. She worked as a research associate at the United Arab Emirates University (2017-2018). She conducted research in the areas of flow of nanofluids, fluid dynamics and published in journals like scientific reports and Neural computing and applications.".

Teresa Donateo

University of Lecce, Department of Engineering for Innovation, Italy

Hybrid Electric Power Systems for Urban air-mobility

Urban air-mobility is an interesting application for electric and hybrid-electric power systems thanks to vertical take-off and landing capability, limited speed (compared with longer distance commuters), short-range requirements and altitudes up to 1000ft.Compared with conventional engine-based power trains, Hybrid Electric Power Systems have the advantage of reducing carbon footprint and noise at takeoff and landing, and increasing safety and reliability thanks to the possibility of electric back-up operation. Compared with battery-based vehicles they allow longer endurance and range and on-board recharge of the battery. HEPS can be powered by fossil fuels or hydrogen as main energy carriers while batteries and super capacitors are used as secondary energy storages. The range and the environmental impact of these systems depend on the synergy between sizing and energy management. This study compares different types of VTOL aircraft configurations and energy management strategies for urban air mobility in terms of indirect environmental impact. For the comparison a new coefficient (gCO2 per km of Euclidean distance) is introduced.

Biography:

Teresa Donateo is an associate professor of Fluid Machinery, Energy Systems, and Power Generation at the University of Salento since 2014. She received her master's degree from the UniversitàdegliStudi di Lecce in 1999 and her Ph.D. in 2003 from ISUFI. She joined the University of Salento as an assistant professor in 2001. She has been collaborating since 2005 with the Ohio State University, Columbus, OH, since 2019 with the University of Brest, Brest, France, and since 2001 with major automotive and aircraft industrial partners. She is associate and guest editor of several journals including the SAE International Journal of Engines, and Nature Scientific Reports. Research topics: simulation, design, and optimization of internal combustion engines, fuel cells, electric and hybrid-electric power trains for aircraft, heavy-duty vehicles, and passenger cars.

Venugopal Arumuru

Indian Institute of Technology (IIT) Bhubaneswar, India

Flow control with Coaxial Synthetic Jets

In this talk, I will discuss a novel configuration of a coaxial synthetic jet (CSJ) actuator in which two piezo-driven single cavity synthetic jet (SJ) actuators are configured coaxially with 0° orientation angle. The single cavity SJ actuators have their own oscillating mechanisms that can be controlled independently. The configuration facilitates the independent control of the operating parameters (amplitude, frequency, and phase difference) for both diaphragms. The CSJ's flow field results from the interaction between the vortex ring evolved through inner orifice (IVR), and through annular orifice (AVR). I will present some experimental and numerical results highlighting the capabilities and distinct features of this novel coaxial synthetic jet for flow control.

Biography:

Dr. Venugopal Arumuru is presently working as Assistant Professor at Indian Institute of Technology (IIT) Bhubaneswar, India. After obtaining his Ph.D.from IIT Bombay in 2014, he joined NUS Singapore as a research associate. He was with GE Measurement and Control India as a Lead Engineer for two years before joining IIT Bhubaneswar in 2016. He has been awarded Young Engineer awards, excellence in Ph.D. thesis award, and teaching excellence awards.
His research group, "Applied Fluids Group", is engaged in applied and fundamental research in fluid-structure interaction, Structural Health Monitoring, unsteady aero-hydrodynamics, turbulence and flow control, electronics cooling,and fluid flow metrology. He has authored more than40 papers in reputed international journals, more than 30 international conference publications, and Eightpatents.

Vladimir Frolov

Samara National Research University, Samara, Russia

Optimum Fuselage Width to Achieve Maximum Lifting Properties of Wing-Body Combination

A solution of the optimization problem is proposed for calculating the maximum lifting properties of the body-wing combination. A combination of a fuselage with an elliptical cross-section and a rectangular wing installed according to the midplane scheme is considered. It has been established that the optimal fuselage width with the ratio of axes of the body equal to 2.0 can equal 30% of the wingspan of the original wing which aspect ratio equal 9. The advantage of the wing-fuselage combination with the elliptical cross-section with the ratio of axes of the body equal to 2.0 over an isolated wing with aspect ratio equal 9 can reach 21% at optimal relative width of fuselage equal approximately 0.3.

Biography:

Vladimir Frolov received Certificate of Associate Professor at Department of Aerohydrodynamics at Samara National Research University, Samara, Russia, in 2012. Currently he works Associate Professor at Department of Aircraft Construction and Design at Samara National Research University and he lectures on aerodynamics to students of the Samara National Research University.

His research interests include problems of wing-body interference and potential flow around bodies. He is the author and coauthor of over 120 publications. He is an author of the book Methods of Calculations Lift of the Combinations Wing-Body. Analytical Overview of Literature, Mathematical Models, Calculate and Experimental Data, Optimization published in Germany (LAP LAMBERT Academic Publishing, 2011) and an author of the two chapters in the book Aerodynamics. Optimization of Lift-Curve Slope for Wing-Fuselage Combination and Critical Mach Numbers of Flow around Two-Dimensional and Axisymmetric Bodies (London, UK, 2021 by IntechOpen). He is also an author of textbook Aerodynamic Characteristics of Aerofoil and Wing (2007). Assoc. Prof. Vladimir Frolov is a member program committee of International Conference on Mechanics, Simulation and Control, in 2014 – present.

Zhaolin Chen a, Tianhang Xiao a, Zhili Tang a, and Ning Qinb

[a]College of Aerospace Engineering, Nanjing University of Aeronautics and Astronautics, 29 Yudao Street, Nanjing, 210016, People's Republic of China.

[b]Department of Mechanical Engineering, University of Sheffield, Mappin Street, Sheffield, S1 3JD, UK

A Multi-objective Optimization of Transonic Low-Reynolds number airfoil based on improved genetic algorithm

Interest in transonic low Reynolds number airfoil design is emerging due to prospective applications like a flight on Mars. The low air density of the Martian environment results in low Reynolds number(103<Rec< 104) flows that promote both flow separation and high viscous drag. On the other hand, A lower speed of sound on Mars limits the rotor tip speed. Therefore, the design of airfoil for low Reynolds number compressible flow of Mars rotor is very prominent. The current study employs a multi-objective genetic algorithm for shape optimization of the doubled-edged thin airfoil to achieve two goals: the generation of both maximum lift and the maximum lift-to-drag ratio at a fixed angle of attack. Airfoil shapes are represented by the Bezier curve with appropriate regularity properties. A multi-objective optimization code is developed, integrated with the Reynolds-averaged Navier–Stokes equations in conjunction with a transitional model. The performance of the algorithm is tested on an analytical test function as well as an aerodynamic-shape-optimization problemin two dimensions.Both on-design and off-design conditions are evaluated for the final optimized shape. Finally, it is shown that the multi-objective genetic algorithm can generate superior airfoils compared to the original airfoils.

Keywords: Compressible aerodynamic, Laminar separation bubble, Low Reynolds number, Mars rotor, vortex flow.

Biography:

Dr. Zhaolin Chen obtained both his MEng(Aerospace Engineering) in 2009 and his Ph.D(Aerodynamics) in 2014 from the University of Sheffield, UK. He started his carrier working as a Post-Doctoral Research Associate at the University of Sheffield after his Pd.D under Professor Ning Qin. He conducted research in the areas of low Reynolds number aerodynamics, investigating the dynamic structure evolution of a laminar separation bubble associated with aerodynamic characteristics at low Reynolds number.

Dr. Zhaolin Chen joined in the department of aircraft design of Nanjing University of Aeronautics and Astronautics in 2019. He is widely interested in the low Reynolds number aerodynamics, airfoil design, conceptual flying vehicle design, etc.

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