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GSEAME2022

2nd Global Summit and Expo on Aerospace and Mechanical Engineering

October 17-19, 2022 **Dubai, UAE**

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FOREWORD

Dear Colleagues,

It is a great pleasure to announce that The Scientistt will host the 2nd Global Summit and Expo on Aerospace and Mechanical Engineering (GSEAME2022) will be held in Dubai, UAE during October 17-19, 2022.

GSEAME2022 aims to bring together the renowned researchers, scientists and scholars to exchange ideas, to present sophisticated research works and to discuss hot topics in the field and share their experiences on all aspects of Aerospace and Mechanical Engineering.

The GSEMSN2022 will be a 3 days event that means to gather the key players of the aerospace and mechanical engineering community and related sectors. This event is launched with the aims to become an established event, attracting global participants, intent on sharing, exchanging and exploring new avenues of Aerospace and Mechanical Engineering -related scientific and commercial developments.

A wide-ranging scientific program consisting of plenary lectures, keynote lectures, Invited lectures, parallel sessions, as well as poster sessions for young scientists covering all topics in Aerospace and Mechanical Engineering will be scheduled. This conference provides a wonderful opportunity for you to enhance your knowledge about the newest interdisciplinary approaches in Aerospace and Mechanical Engineering.

Moreover, the conference offers a valuable platform to create new contacts in the field of Aerospace and Mechanical Engineering, by providing valuable networking time for you to meet great personnel in the field.

We look forward to seeing you at GSEAME2022 in Dubai, UAE.

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Day-01

Jae-Woo Lee*

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Operational Digital Twin Technology for Reliable and Autonomous Urban Air Mobility

Abstract

Urban Air Mobility (UAM) has emerged as a promising and futuristic transportation paradigm in metropolitans, which is expected to revolutionize traditional ground transportation infrastructures to bring about efficient and safe day-to-day commutes to citizens. UAM is another layer of urban transportation along with ground transportation to leverage a much faster passenger and freight transportation thanks to potentially higher speeds and less traffic of personal aerial vehicles (PAV) [1]–[3]"container-title":"EASA","language":"en","title":"Urban Air Mobility (UAM. Digital Twin technologies can provide constituents with real-time data of all assets and events, enabling them to take timely action[4]. Fundamentally, a DT is a virtual replica of a physical object or process with the ability to simulate real-time changes in the virtual environment by consuming and processing the data from sensors and various feeds from physical objects.

In UAM, operational digital twin (ODT) is the core of air traffic network and management for high-quality and trusted air operations in UAM. ODT in UAM is generally the high fidelity and real-time abstraction and simulation of a real-world UAM infrastructure. The core of ODT is a couple of physical twin and abstracted digital twin of air vehicles and traffic operations that together evolve over time[5], [6]. In practice, air transportation requires a much higher level of safety compared to ground vehicles. Advanced ODT along with AI technologies are essential for faster and easier prediction of potential risks for proactive management and abnormal situation responses that can enhance level of air traffic's reliability and autonomy.In this talk, we present (i) UAM Operation Infrastructure, (ii) Digital Twin Technologies for UAM Operations, (iii) Reliable and Autonomous UAM by Operational Digital Twin. This talk can provide comprehensive ideologies and demonstrations of UAM-ODT development in real-world for high-fidelity abstraction and simulation of air vehicles, flight operations and air traffic control in the future UAM infrastructures, shown in Figure (1), to secure reliability and autonomy of citizens' air commute in metropolitans.

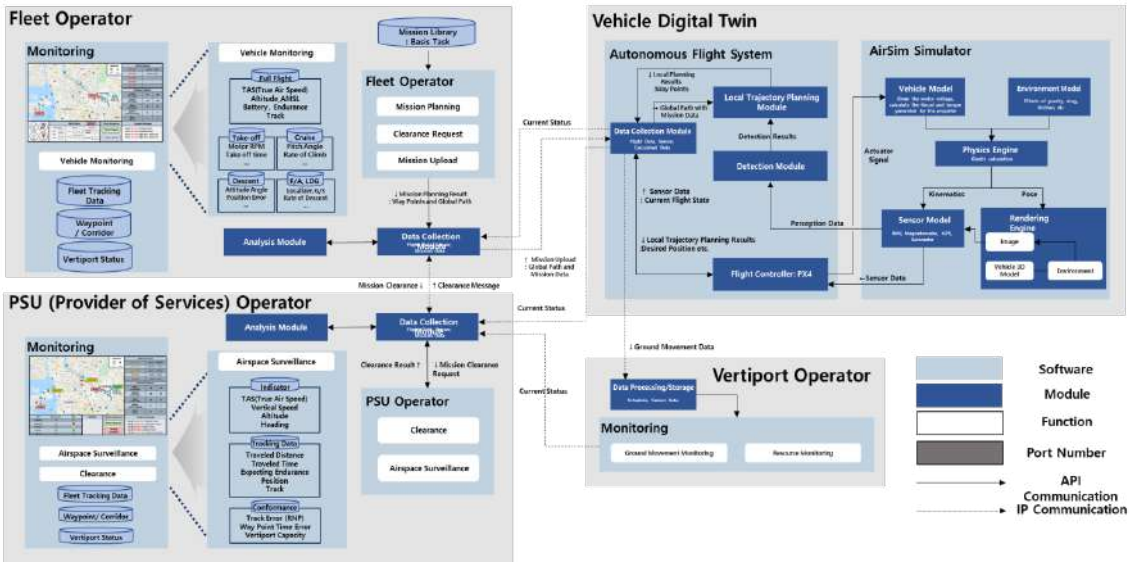

Figure (1) Operational Digital Twin Technology Architecture for Reality and Autonomy UAM

Keywords
UAM, UAM operations, Digital twin, Operational Digital Twin, Reliable UAM operations, Autonomous UAM operations

References
[1] "Urban Air Mobility (UAM)," EASA. https://www.easa.europa.eu/domains/urban-air-mobility-uam (accessed Apr. 21, 2022).
[2] A. Straubinger, R. Rothfeld, M. Shamiyeh, K.-D. Büchter, J. Kaiser, and K. O. Plötner, "An overview of current research and developments in urban air mobility – Setting the scene for UAM introduction," J. Air Transp. Manag., vol. 87, p. 101852, Aug. 2020, doi: 10.1016/j.jairtraman.2020.101852.
[3] "Urban Air Mobility Concepts of Operations – KADA." http://kada.konkuk.ac.kr/2021/06/09/urban-air-mobility-concepts-of-operations/.
[4] A. Fuller, Z. Fan, C. Day, and C. Barlow, "Digital Twin: Enabling Technologies, Challenges and Open Research," IEEE Access, vol. 8, pp. 108952–108971, 2020, doi: 10.1109/ACCESS.2020.2998358.
[5] M. Tyan, A. A. Maw, K. Jeon, M. Jang, and J.-W. Lee, "Digital Twin System for Future Urban Air Mobility. Technology Overview."
[6] T. A. Nguyen, D. Minh, and J.-W. Lee, "iUAM: Service Survivability of Digital Twin Urban Aerial Mobility."

Biography
Jae-Woo Lee, Professor
He is presently a Professor and Director at Konkuk Aerospace Design·Airworthiness Institute (KADA), Konkuk University, Seoul, South Korea.
His research interests include UAM operations infrastructures, UATM system, autonomous flight system, mission planning and replanning, high-fidelity flight simulation, flight control system, multidisciplinary design, and optimization, MDO, aerodynamic design and optimization, aerospace vehicle design for aircraft, space launcher, UAM/UAV/Drones.

Prof. Gabriele Arcidiacono
Guglielmo Marconi University, Italy

Society, Industry, Education: Excellence 5.0

Abstract
In modern companies, the need to have metrics capable of guiding strategic decisions, corporate behavior and technological development is growing.

At the same time, it is necessary to develop specific skills that allow us to better manage the resources we have, reaching ever higher skills in time management in a broad sense as well as in the specific planning and control of the activities and projects with which companies are daily called to confront each other.

The above fits into a global context within which the word change dominates, to be read however in its positive sense of challenge towards improvement.

An improvement that, to be truly such, must be based on a long-term strategy, with a view to sustainability and continuity: in the Education area, in the Industrial area, for the whole Society.

Biography
Full Professor of Machine Design and Head of Department of Engineering Science at G. Marconi University (Rome, Italy). Chairman of Interuniversity Research Center “StEering” (Statistics for Engineering) promoted by University of Florence, Marconi University, and the University of Cassino and Southern Lazio. Board Member of Machine Design Italian Scientific Society (ANVUR recognized) and of the Working Group Design for Additive and Lean Manufacturing. President of Leanprove Foundation, a non-profit organization created, as founding members, by Nestle Group, Janssen of the Johnson & Johnson Group, Leonardo Group, Santander Consumer Bank, ANIA (National Association of Insurance Companies), and Il Sole 24 Ore. M.Sc. in Mechanical Engineering (1993) at the University of Florence (Italy) and Ph.D. in “Machine Design” (1998). Visiting Professor (1998) and Guest Researcher (2000) at Massachusetts Institute of Technology (MIT), Boston, USA. Official teachings and research assignments abroad (MIT Boston-USA, Wayne State University Detroit-USA, Kiev National University, University of Business and Technology (UBT) in Jeddah-Saudi Arabia). He developed and implemented the first Six Sigma program in Italy (General Electric, 1996), and thereafter he has been leading this program in over 300 companies (such as Toyota, FCA, Ferrari, Nestlè, BASF, Johnson & Johnson, Santander, Unicredit, Honda Motor, Piaggio, Pfizer, MSD, Roche, Abbott, Electrolux, Technogym, Leroy Merlin, Poste Italiane), in Europe, North America, South America, and Asia. Invited to disseminate the evolution of the Lean Six Sigma methodology, he has given speeches on all six continents. Member of Editorial Advisory Board of International Journal of Lean Six Sigma. Member of Editorial Advisory Board of International Journal on Advanced Science, Engineering and Information Technology. Member of Editorial Board of “Design Engineering and Science”, Nam P. Suh et al., (Springer). Guest Editor of the Special Issue on “Mechanical Characterization of Parts Fabricated by Additive Manufacturing”, 2020, Part C: Journal of Mechanical Engineering Science (SAGE). Guest Editor of the Special Issue on “Automotive Reliability”, Volume 20 (2) 2004, Quality and Reliability Engineering International (John Wiley &

Sons). Research topics: Lean Six Sigma, Lean Six Sigma 4.0, Design for Six Sigma, Axiomatic Design, Design of Experiments. Author of 140+ scientific papers and 12 books, including Lean Six Sigma: Kaizen Leader and Green Belt Handbook (co-author Kai Yang) the most widely used book in Italy by industry experts (15,000 copies sold) and Lean Six Sigma in Healthcare system (coauthor Daniel T. Jones), presented in presence of the Italian Health Minister.

Suhail Hyder Vattathurvalappil
King Fahd University of Petroleum and Minerals, Saudi Arabia

Development of Hybrid Reversible Adhesives for Dissimilar Material Joining Using Electromagnetic Induction Heating

Abstract
Structural joining has recently been recognized as one of the primary challenges in the integrity of critical structures and wide acceptance of composite materials in mass produced aerospace, petroleum, marine, and other engineering applications.

Thermoplastic polymers doped with conductive nano/micro particles known as “reversible adhesives” allow for selective heating of thermoplastic polymer adhesives through coupling with electromagnetic (EM) radiations via non-contact methods. This facilitates increasing the adhesive temperature above the processing temperatures in a short duration, which upon cooling forms a structural bond.

Hence, this process is attractive as it enables similar and dissimilar light weight material joining’s through quick assembly, removal, and re-assembly without the need to heat the entire component (selective heating of the adhesive). It offers excellent solution for pipeline and structural joining’s in automotive, aerospace, and other engineering applications where lightweight multi-material joining is desired.

Biography
Dr. Suhail Hyder Vattathurvalappil is an assistant professor in the department of aerospace engineering at King Fahad University of Petroleum and Minerals. He joined KFUPM from Michigan state university, where he focused on structural joining’s, additive manufacturing and green composites applied to automotive and aerospace vehicles. Dr. Suhail completed his PhD from michigan state university and subsequently worked as a postdoctoral research associate at composite vehicle research center, michigan. He obtained his master’s degree in aerospace structures from Institut Superieur del’aeronautique et de l’espace (ISAE) and bachelor’s degree in aerospace engineering from Anna university. His current funded research at KFUPM focuses on renewable materials and sustainable manufacturing techniques for smart and eco-friendly structures.

Jan Kazmierczak
Silesian University of Technology, Poland

Is The Technology Assessment Paradigm Present In University Educational Programs In Poland?

Abstract

The first part of the article presents general considerations on the need to consider the issues of assessing the impact of - incredibly innovative - products and technologies on various aspects of the functioning of individuals, social groups, and societies in the modern world. The following parts of the article show the assumptions and selected results of questionnaire studies focused on the presence of TA issues in education programs, separately in Polish technical and medical universities. The next part of the article contains a discussion of the results of the research conducted so far and perspective directions and methods of further study in the discussed area of issues. In summary, the author's thoughts on the necessary changes in the approach to staff training for the future are presented, especially regarding the required changes in education models.

Biography

Prof. Jan Kazmierczak, D.Sc. born on 4th April 1950 in Katowice, Poland In 1974 he graduated from the silesian university of technology .In 1981 he obtained a doctoral degree and in 1989 a postdoctoral degree based on the dissertation application of linear models of random processes to forecasting in machine diagnostics . In 1997 he was awarded the title of professor of technical sciences. He specializes in the theory of machines and mechanisms. Professionally associated with the silesian university of technology, he headed the department of fundamentals of technical systems at the faculty of organization and management . From 2007 to 2015 he is the Member of the Sejm (Parliament) of the Republic of Poland, Chairman of the Parliamentary Sub-Committee on Science and Higher Education, Vice Chairman of the Parliamentary Committee on Innovation and New Technologies. In 2019, he became the dean of the faculty of organization and management of the silesian university of technology in zabrze. He also became the director of the institute of production engineering of the silesian university of technology and the deputy chairman of the production engineering committee at the polish academy of sciences . His Areas of Scientific Interests are Production Engineering, Innovation Management, Assessment of Social Impact of New Technologies and Products (Technology Assessment - TA), Maintenance Management, Engineering of Acoustical Environment, Computer-Aided Engineering, Smart city, Industry 4.0 His Areas of Research Projects are expertise in the area of implementing and assessing innovations, management of data from maintenance od technical systems, implementations of tools of CMMs class (Computerized Maintenance Management systems) and ERP (Enterprise Resource Planning) in industrial practice, development of acoustic maps using GIS technology, implementation of the Industry 4.0 paradigm in MSME's (Micro-, Small- and Medium-sized Enterprises), practical aspects of the SMART CITY concept.

Prof. SUT Aleksandra Kuzior, PhD,Dsc.,Dr.h.c

Prof. SUT Aleksandra Kuzior, Katarzyna Postrzednik-Lotko, PhD

Silesian University of Technology, Faculty of Organization
and Management, Department of Applied Social Sciences.

Participatory Model in Technology Assessment

Abstract

Technology Assessment (TA) is the concept of consulting scientific thought on controversial or socially sensitive technological issues. The origins of TA go back to the 1970s. In 1972, the Bureau of Technology Assessment (OTA) was established at the US Congress - the birth of the institutionalized TA. Initially, TA was dominated by experts and essentially saw itself as an arbiter on controversial technical issues: through interdisciplinarity, it was believed that there were reasonable options to control the development of technology.

In the 1980s - in the period of growing social skepticism towards experts and science - TA spoke out constructively about the postulate of broadening social participation. In this way, a canon of methods was created that included people who are usually not involved in the design and evaluation of technology. This has become popular as “participatory technical assistance” (participatory technology assessment) or “constructive technical assistance” (constructive technology assessment).

The basic methods of the participatory model in TA were mainly developed in the course of controversies related to nuclear and genetic engineering. However, in this context, doubts may arise as to whether participatory processes should contribute to making technology and innovation available to the public. Indeed, the aim of constructive technical assistance is to involve the relevant actors in technology development at an early stage in order to ensure that society benefits from these technological innovations, as this objective is based on the belief that the origins of technology are largely shaped by societal expectations and goals.

Biography

Prof. SUT Aleksandra Kuzior, PhD,Dsc.,Dr.h.c., habilitated doctor, Professor SUT, Doctor Honoris Causa. Vice-Dean for Cooperation and Development, Head of Department of Applied Social Sciences, President Silesian Center of Business Ethics and Sustainable Development, Vice-president of the Polish Association for Technology Assessment. Chair woman of the Committee on Corporate Social Responsibility at the Regional Chamber of Commerce. Manager of 8 completed projects financed by the European Social Fund, National Center for Research and Development and National Agency for Academic Exchange. Author of over 200scientific publications. Laureate of numerous awards, including: Medal National Education Commission, Award Minister of Education and Science.

Bartlomiej Knosala
Silesian University of Technology, Poland

Industry 4.0 in the Perspective of a Hermeneutic Technology Assessment Model

Abstract

The aim of the paper is to indicate the main narratives functioning in the public sphere, the subject of which is industry 4.0. The theoretical basis is the concept of Armin Grunwald presented in "The Hermeneutic Side of Responsible Research and Innovation". According to Grunwald, one of the main factors determining the development of a given technology are narratives about the future. This means that assessing new and emerging technologies and research (NEST - New and Emerging Science and Technology) can be done by assessing the narrative. This approach allows a given technology to be assessed before it is fully applied to society. From this perspective, Grunwald's proposal allows us to overcome the so-called the control dilemma formulated by David Collingridge, according to which "it is either too early to effectively predict the impact of a given technology, or it is too late because innovation is already so closely related to other elements of culture and society that it cannot be transformed "(Bińczyk 2012: 27). At the same time, the hermeneutic model of technology assessment may become the basis for the creation of the so-called anticipatory governance, which could be an alternative to Hans Jonas' precautionary principle.

When analyzing the narratives about industry 4.0, the following approaches can be distinguished:

- techno optimistic approach - industry 4.0 will solve growing global problems - both ecological and social;
- technological unemployment - industry 4.0 will lead to irreversible job losses;
- an oppressive approach - industry 4.0 (and the entire fourth technological revolution) will deepen genederal and racial prejudices and will have a negative impact on the natural environment.

Keywords

technology assessment, narrative turn, anticipatory governance, technological unemployment, techno slutionism

Biography

Bartłomiej Knosala, Ph.D., assistant professor at the Faculty of Organization and Management of the Silesian University of Technology. Author of a monograph showing Marshall McLuhan's thought from the perspective of the classical trivium and philosophy of Giambattista Vico, entitled The new Marshall McLuhan science project. Philosophical consequences of changes in forms of communication. In 2019, he participated in the preparation for printing of the first Polish translation of the Buckminster Fuller Manual Operating for Spaceship Earth.

Katarzyna Postrzednik-Lotko, PhD

Silesian University of Technology, Faculty of Organization and Management, Department of Applied Social Sciences.

Assessment of GCI Technology in Digital Marketing

Abstract

For many years, the human imagination has been heated by the vision of the coexistence of humans with robots, their mutual relations, if only because many movies, books, games have touched on this theme. Where will humanoid beings be able to replace human beings? How far in the future will this happen? The future becomes a reality with the advancement of computer graphics. Its current possibilities applied in influencer marketing allowed to create a new form of life - digital influencers. Digital influencers are virtual characters, computer-generated imagery (CGI). They are a unique substitute for human influencers. We have had the opportunity to admire the effects of CGI technology many times in film productions in which fantastic characters came to life.

However, the use of digital influencers in marketing is not without its drawbacks. A computer-generated character can evoke what is known as an “uncanny valley”. This term describes the anxiety experienced when interacting with a human-shaped robot. The better the robot imitates a living being, the more anxious it will be. Digital influencers are still a new and rare phenomenon in the Internet space. The more so as people by nature are concerned about innovative concepts.

The use of digital influencers in marketing is undoubtedly worth attention. As CGI technology continues to advance, this could fundamentally change the face of internet marketing. For some, such innovations evoke admiration, for others, distance, an unpleasant feeling of weirdness. Although they are present today, they are rather a projection of the future.

Biography

Katarzyna Postrzednik-Lotko, PhD, assistant professor, SUT, studied German at the University of Opole and at the University of Heidelberg, certified translator of German, many time grant holder of DAAD, defended her doctoral dissertation regarding Polish-German relations of the interwar period in 2007 at the University of Opole, obtaining the PhD’s degree. 2007–2014 Dean of the Opole Department of the Bogdan Jański Higher Education School. 2015-2019 Subject Matter Expert at Teleperformance Germany Sp. z o.o., responsible for Quality Assurance on Amazon project. Her scientific interests focus on social communication, communication flow in modern global enterprises, as well as technology assessment.

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Damage Identification for Space Structure by Regularized Approaches

Abstract
Structural damage identification is a key issue for several sectors, and the damage issue can be formulated as a class of inverse vibration problem. This inverse problem can be formulated as a generalized least square problem. The stiffness matrix is the goal for the identification process, where the measurements are the reference for the best matching with a mathematical model associated with a regularization operator. The forward problem is solved by the finite element method, and an entropic regularization is also used for the cost function. Here, two types of inverse methods will be applied. An inverse solution is estimated by combining a stochastic metaheuristic (MPCA: multi-particle collision algorithm) with a local searching method (HJ: Hooke-Jeeves) [1], and a second technique employing a variational approach [2]. The proposed methodologies are applied to different study cases: the cantilever beam and space truss structure, the last one as a simplified representation of the International Space Station (ISS).

Keywords
Damage identification, regularized inverse solution, hybrid optimization techniques, Multi- Particle Collision Algorithm (MPCA) and Hooke-Jeeves (HJ) method, variational scheme.

References
[1] R. Hernández Torres, H. F. Campos Velho, L. D. Chiwiacowsky, Chapter 5: Computational Intelligence, Optimization and Inverse Problems with Applications in Engineering (G. M. Platt; X.-S. Yang; A. J. Silva Neto. (Org.)), 87 – 109, Springer Nature, (2019).
[2] L. D. Chiwiacowsky, P. Gasbarri, H. F. de Campos Velho, Acta Astronautica, 62, 592 – 604, (2008).

Biography
Haroldo F. de Campos Velho: Senior researcher at the National Institute for Space Research (INPE, Brazil), with interest on inverse problems for space research, data assimilation, hybrid computing, and mathematical turbulence modeling.
Reynier Hernández Torres: Independent researcher with experience in scientific computing, artificial intelligence, computer vision, and data science.
Leonardo D. Chiwiacowsky: Adjunct professor at the University of Caxias do Sul (UCS, Brazil), with experience on computer science, production engineering, aeronautics and mechanics, with a focus on linear and non-linear optimization, computer simulation, multi-criteria decision analysis, and high-performance processing.

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Control of Combustion and Pollutant Emissions by EGR "Exhaust Gas Recirculation"

Abstract

Exhaust Gas Recirculation (EGR) has long been designed, installed, and practiced as a means of dilution and control in many combustion systems [1].The main objective of this technology lies in the obligation to satisfy current emission regulations based on the reduction of particles emissions and gas pollutants, in particular nitrogen oxides NOx[2]. The dilution by CO2, H2O or EGR can cause flame instabilities, and even blow-outs if the diluents concentrations are important. Oxygen enrichment at small fractions avoids these instabilities [3].Besides, the increase of CO2 concentration by the EGR and O2 enrichment improves the CO2 capture efficiency [4].This paper reports some results from the investigation of exhaust gases (water vapour and CO2) recirculation effects, with and without O2 enrichment, on non-premixed turbulent flames stabilized by a swirl burner. We are interested in pollutant emissions, flame stability through the determination of lift-off heights by analysing the emission of OH* radicals and flow fields by PIV measurements. Several parameters of the burner are studied as the swirl number, the global equivalence ratio, and the fractions of O2, H2O and CO2 in the mixture.

Keywords

Oxygen enrichment; H2O/CO2 dilution; Swirling flame; Flame stability, Control of flame; Pollutant emissions

References

[1] W. Shen and al. Energy, Volume 249, 15 June 2022.
[2] H. Zaidaoui et al., Combustion Science and Technology, Volume 193, 2021.
[3] Baukal, Charles E. Oxygen-Enhanced Combustion, 2nd edition, CRC Press LLC (2013).
[4] Favre, E., Bounaceur, R. and Roizard, D. 2009.Sep. Purif. Technol. 68 (1), pp. 30–36

Biography

Dr. Toufik BOUSHAKI is currently Associate Professor at the University of Orleans in the Mechanical Engineering field. His research activity is donein the ICARE laboratoryof the CNRSinthe combustionarea.In 2022, he spent 6 months at Massachusetts Institute of Technologyas Visiting Scholar.He worked on new fuels in Reacting Gas Dynamics Laboratory in the Center for Energy and Propulsion Research. He received his Ph.D in Applied physics (2007) and DEA (postgraduate degree) in Reacting Flows (2003) from the INSA of Rouen in France. Dr. Boushaki obtained hisengineeringdegree (M.Sc.) in Mechanical Engineering from Blida University in Algeria (1999). His research topicsconcern turbulent combustion, control offlames,plasmaand pollutant emissions. He is the secretary of French committee of IFRF member of the French section of the Combustion Institute.

Dr. Delia Dimitriu
Manchester Metropolitan University/Smarter Mobility Solutions, UK

The Role of Innovation Actions in Decarbonising Aviation

Abstract
The paper presents the role of innovation actions in testing solutions to decarbonise aviation within an integrated low carbon/carbon neutral transport system. The focus on airport cities will show the need to scale up demonstration to market responsiveness, underlying the position of renewable energy at the level of aircraft (SAF, electric, H2), airside, terminal area and connectivity to cities around an airport.
The role of key exploitable results to be replicated in other airport-cities will also be mentioned, while underlying the UK ambition on UAM and decarbonisation. Challenges with people's perception on the excessive use of technologyand their acceptance will also be tackled.
The paper concludes with the need to link policy-research-practice to end-users, and focus more on IA (innovation actions) thank on RIA(research & Innovation action), as this approach will speed up decarbonisation and will create green jobs.

Day-02

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Orbital Debris Hazards – Protection of Space Vehicles

Abstract
Space activity of the humanity generated a great amount of orbital debris; i.e. manmade objects and their fragments launched into Space, inactive at nowadays and not serving any useful purpose. Those objects sizing from hundreds of microns up to decimetres, travelling at orbital velocities, remaining in orbits for many years and numbering billions formed a new media named "space debris" and became a serious hazard to space flights. Collision with a debris metallic particle of 1 cm radius is energetically equivalent to a collision with a ton mass car moving at a speed 100 km per hour.

Effective mechanical shielding of Space vehicles is an acute problem since the flights in outer Space face the Space debris problem, especially at low Earth orbits and geosynchronous orbits. The main idea of protecting Space vehicles from hypervelocity small (character size of 1 cm order) fragments is to dissipate the impact energy in some way by the shielding layer. Simple increasing of the vehicle shell thickness is not effective as at speeds of the order of kilometers per second, the depth of penetration is big and the total weight becomes unacceptable for a practical usage.

The new concept suggested by the Authors states that protecting the spacecraft by a honeycomb of small gas-filled containments could form a much more efficient shield with lower mass. As multi-sheet shielding concept uses thin shield elements to repeatedly shock the impacting projectile to cause its melting and vaporization, so is the new gas-filled containment shield concept still using continuous effect of pressurized gas to cause fragments slowing down, heating, melting, atomization and evaporation. Besides, using many successive layers of gas-filled spherical bumpers makes it possible to increase the area of the zone of impact energy redistribution and dissipation including the side and front walls of bumpers due to the property of gas to transmit pressure in all directions, which provides a considerable advantage to the present concept as compared with multi-layer shields. The gas-filled bumper shields could be reusable, as the rate of gaseous phase leakage effect on depressurization is rather low and the loss of mass is negligible during the characteristic time of impact.

The project got a financial support from Russian Science Foundation (Nr 18-11-00225).

Keywords
Space debris, hypervelocity collision, shielding, dissipation

Biography
Prof., Dr.Sc. habilitat Nickolay N.Smirnov is a head of lab in Moscow M.V.Lomonosov State University. Currently he is also holding half a position of head of strategic information technologies in the Federal Science Center. Corresponding Member of Russian Academy of Natural Sciences since 1998, academician since 2007. Corresponding Member of International Academy of Astronautics

since 2005, Academician – since 2008, Commission 1 Space Physical Sciences Chair (2013-2018). Awarded Kapitsa Gold Medal of the Academy of Natural Sciences for the scientific discovery (2007), S.P. Korolev (2007), M.V. Keldysh (2008), G.A.Tyulin (2014) and Yu.A.Gagarin (2015) medals of the Russian Federation of Cosmonautics, V.G. Grabin medal of the Russian Academy for Rocket and Artillery Sciences (2009), Kh.A. Rakhmatulin medal of National Committee on Theoretical and Applied Mechanics (2010). Awarded the honor title "Distinguished professor of Moscow M.V.Lomonosov State University" in 2017. Distinguished service Award from the International Astronautical Federation in 2019 for the outstanding contribution to the Microgravity Science and Process Committee.

L.Stamov*

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Computer Simulation of Processes in Combustion Chamber of Solid Fuel Hybrid Rocket Engine

Abstract

In this work a three-dimensional numerical modeling of the processes occurring in the combustion chamber of a hybrid engine was done. The HTPB (Hydroxyl-terminated polybutadiene) and PMMA (Polymethyl methacrylate) were consideredas solid fuels. Gaseous oxygen and air were used as the oxidant.The developed model assumes that a preliminarilyheated gaseous oxidizer injects in the chamber and interacts with the surface of the solid fuel, heats up and ignites it. As a result, productsof the decomposition of the solid fuel in gaseous form enters in the chamber, interacts with the oxidizer flow and ignites. The MUSCL method of interpolation of the flows on the face of the computational cells in the numerical model was used. The AUSMP method for the compression terms on the uniform cubic grid and the semi-implicit Novikov method for the rigid system of kinetic equations were implemented. Also the Wilcox k-w model of turbulence wasselected. The OpenMP technology was user for parallelization of the current algorithm.The chamber geometry was based on the geometry of the experimental combustion chambers. A comparison with experimental data was done. A series of the computational experiments was carried out.The distributions of the physical parameters inside the combustion chamber were received. The influence of solid fuel geometry on the occurring processes was studied. A diffusion mode of the combustion process in the combustion chamber and a strong instability at the beginningwere obtained.

This work was supported by the grant in the form of the subsidy of the Ministry of Science and Education of Russian Federation on the topic: "Investigation and development of detonation combustion chambers being used in perspective aerospace propulsion systems" (No. 075-15-2021-1385).

Keywords

hybrid engine, combustion, solid fuel, computational modeling, regression rate.

Biography

LyubenStamov, Ph.D., Senior Researcher of the Department of Computer Systems of the Federal Science Center "Scientific Research Institute for System Analysis of Russian Academy of Sciences", Russia. Graduated from the Transnistrian State University named after T.G. Shevchenko in 2010. Awarded qualification of mathematician, system programmer with a degree in applied mathematics and computer science. In 2010 became a Postgraduate of the Department of Gas and Wave Dynamics of Mechanics & Mathematics Faculty of Lomonosov Moscow State University. Maintained a thesis in 2021 and got a degree Ph.D. in the field of physics and mathematics.Topic: "Mathematical

modeling of non-equilibrium detonation and combustion processes, as well as transient modes on multiprocessor computers". He is the author/co-author of more than 65 scientific papers, 2 patents, 4 certificate of registration of software rights.

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A Study of a Pulse Detonation Chamber Cycle for Propulsion Purposes

Abstract

As an alternative to the traditional combustion of fuels in a turbulent flame, the method of their combustion in detonation waves is currently being considered. It allows intensive, more thermodynamically favorable and stable combustion of various fuels in annular chambers of small dimensions, determined by the characteristic size of the detonation wave front. The pulsing (PDE) and rotating detonation (RDE) wave engines have attracted increasing attention over the past two decades. The RDE type is the most preferred in view of the continuity of the processes taking place. Currently, most RDE studies are based on hydrogen and ethylene, and kerosene-based mixtures are also being considered. In early research, the addition of hydrogen or oxygen was the primary method of initiating liquid kerosene/air spinning detonation. For example, Bykovsky et al. experimentally initiated rotating detonation waves on kerosene, they reported that rotating detonation waves could only be obtained by increasing the mass ratio of oxygen/nitrogen to 1:1. Their subsequent research continued to use the addition of some more active propellants, i.e. hydrogen or synthesis gas to produce self-sustaining rotating detonation waves. In this paper, a three-dimensional numerical simulation of the detonation combustion chamber was carried out, the study of which was carried out experimentally by Bykovsky and his collaborators for RDE device. Oxygen was considered as an oxidizer, hydrogen or acetylene was considered as a fuel. The obtained results are compared with experimental data. For PDE this work describes the most important part of this cycle: ignition, combustion, and detonation of the flammable mixture.This work was supported by the subsidy of the Ministry of Science and Education of Russian Federation on the topic: "Investigation and development of detonation combustion chambers being used in perspective aerospace propulsion systems" (No. 075-15-2021-1385). We would like to express our gratitude to the Center for Collective Use of the Joint Supercomputer Center of the Russian Academy of Sciences for the provided computing resources.

Keywords

hybrid engine, combustion, solid fuel, computational modeling, regression rate.

Biography

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October 17-19, 2022 | Dubai, UAE

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Fluids Behavior under Microgravity Conditions: Experiments and Mathematical Modeling

Abstract

The study of the features of processes associated with multiphase fluid flows in microgravity conditions is of great importance both for the development of space technologies and for some terrestrial applications. It is well known that the behavior of a fluid under conditions of reduced gravity differs significantly from behavior under terrestrial conditions.

Under conditions of reduced gravity, capillary effects become the main driving force in the flow of liquids. For example, on board the space station, the supply of liquid from a reservoir (for example, fuel) is possible only due to capillary forces. Also, capillary effects play an important role in the movement of fluids in heat pipes of spacecraft thermal control systems.

Capillary effects strongly influence the seepage processes under terrestrial conditions, but the study of capillary effects under standard gravity is difficult: it is problematic to visualize the liquid flow in small pores, and capillary imbibition is impossible in large pores due to the prevailing gravity. Therefore, it is so important to conduct experiments on the flow of liquid due to capillary effects in microgravity.

This paper describes experiments on capillary impregnation at a station in Earth orbit, as well as during parabolic flights: 1) experiments on repeated impregnation of an artificial porous medium (glass balls of various diameters) during parabolic flights of the Airbus A300-ZeroG aircraft organized by the European Space Agency, 2) experiments on capillary impregnation of natural porous medium (80% quartz sand and 20% kaolinite) on the Discovery STS-91 orbiter carried out within the framework of the MIRROR GAS program. The features of the experiments, experimental equipment, post-processing of experimental data are described. Experiments in microgravity are very time-consuming and expensive. Therefore, it is important to develop mathematical models and numerical schemes for predictive simulations of fluid flow in microgravity. Description of the behavior of fluids in microgravity requires special mathematical models, which are described in this paper. Comparison of the results of numerical simulations with experimental data makes it possible to develop verified software packages. Despite the active development of digital technologies and computational capabilities for numerical simulation, it should be noted the importance of conducting real experiments under microgravity conditions.

The authors wish to acknowledge the support by Russian Science Foundation (Grant initiative 21-71-10023).

Keywords

parabolic flights, microgravity, porous medium, capillary effects

Biography

Skryleva Evgeniya has been working as a researcher at the M.V.Lomonosov Moscow State University since 2014. In addition she has been working in the Scientific Research Institute for System Analysis of the Russian Academy of Sciences since 2015. She has been a member of IAF(International Astronautical Federation) Microgravity Sciences and Processes Committee since 2021. Skryleva Evgeniya has participated in more than 10 grants for research. She obtained one patent and four certificates of registration of software rights. 4 training courses at M.V. Lomonosov Moscow State University are taught by Evgeniya Skryleva. She has published 2 books and more than 30 papers in journals and more than 50 communications to scientific meetings in the fields of Space Physical Sciences, Mathematical modeling, Wave Dynamics. H-index = 5 (Scopus), 3 (Web of Science). Awards: • Lomonosov Moscow State University scholarship for young employees, graduate students and students who have achieved significant results in teaching and research activities (2021), • Scholarship of the President of the Russian Federation for students and Ph.D. students (2018-2019), • A.Ya. Sagomonyan Commemorative Medal (april 2019), • Scholarship of the President of the Russian Federation for young scientists and Ph.D. students engaged in advanced research and development in priority areas of modernization of the Russian economy (2019-2021) • Winner of the “UMNIK” program for the project “Development of models of the process of displacement of viscous liquids from a porous medium and research of methods for enhanced oil recovery” (2015).

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Branching Fractures Growth in Constructing Materials

Abstract

All bodies have internal defects. They can be inside the body or be on the surface. Such defects are named cracks. The presence of one or more cracks can lead to destruction, which is very dangerous. In this case, cracks often have a branching structure.

In this paper, we study branching cracks under internal pressure. Cracks of various shapes have been investigated. They can consist of three rectangles, three semicircles and their various combinations. Stress intensity factors for branching cracks are found.
The calculations were carried out on the basis of the original author's program, which makes it possible to determine the stress and displacement fields in a three-dimensional elastic body weakened by a system of arbitrarily oriented cracks. The numerical code is based on the method of discontinuous displacements, applied to three-dimensional problems of fracture mechanics in an elastic medium, implemented in C ++ codes. The main purpose of the work is to demonstrate the possibility of determining the stress intensity factors for a spatial branching cracks and their dependence on the geometric parameters of the problem.

Biography

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Effect of Geometric Parameters on Critical Force Inducing Nonlinear Deflection of Orthogonal Frames

Abstract

Nonlinear large deflection of cantilever beam due to geometry is discussed [1]. It is also found in micro awl-shaped springs made of silicon [2]. In this work, the anchor deformation effect on nonlinear deflection of orthogonal frames is investigated. Effects of geometric parameters of orthogonal frames on nonlinear deflection caused by bending moments are investigated in this work by finite element method software COMSOL. The nonlinear deflection is defined happening when the difference between linear and nonlinear deflections is 5 % of linear deflection [3]. The applying transverse forces are defined as critical forces. These critical forces are considered as index of nonlinear deflections of horizontal beams of vertical frames. From the results, the fixed type of vertical member has the most important effect on critical force of nonlinear deflection. For every vertical member dimension, comparing with cantilever beam, orthogonal frame with vertical member fixed on bottom will induce smaller critical force.For the same horizontal beam length, width of vertical member has significant effect on critical force of nonlinear deflection as shown in Figure 1. The critical force will increase fast as the width increasing. And the critical force will decrease as the height of vertical member increasing. The length of vertical member has no obvious effect on critical force as shown in Figure 2. And the critical force will nonlinearly decrease as the length of horizontal beam increasing.In this work, it is found the geometric parameters of orthogonal frame will affect the nonlinear deflection. By the results of this work, it would help the design of orthogonal frames.

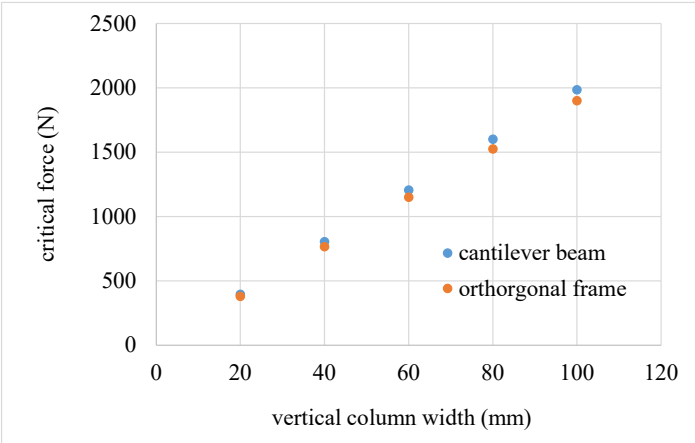

Figure 1

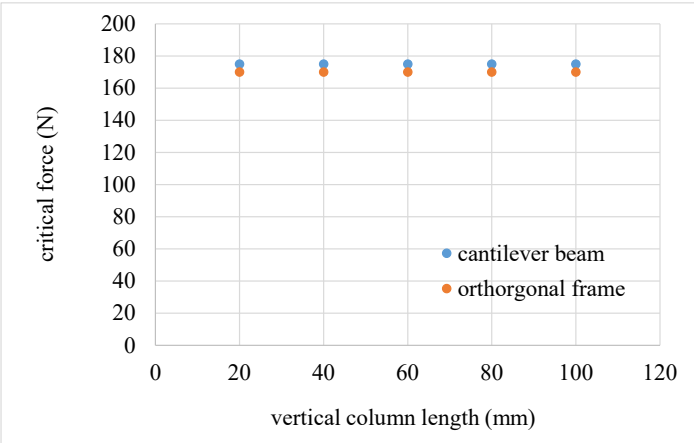

Figure 2

Keywords

orthogonal frame, cantilever beam, deflection, nonlineardeformation

References

M.-J. Lin, H.-M. Chou, R. Chen, Mater., 13, 12, 2864, (2020)
K. E. Bisshopp, D. C. Drucker,Q. Appl.Math., 3, 272–275, (1945).
C. C Wu, M. J. Lin, R. Chen, Sens. Mater., 20,457–466, (2008).

Biography

Meng-Ju Lin received his BSand PhD degrees in Power Mechanical Engineering from National Tsing Hua University, Hsinchu, Taiwan, in 1990 and 2002 and his MS degree in Applied Mechanics from National Taiwan University, Taipei, Taiwan in 1992. He is currently the associate professor in the Department of Mechanical and Computer Aided Engineering, Feng Chia University, Taiwan. His research interest's includes ticking effect, mechanics of micro springs thermal stress and deformation in MEMS, mechanics of bistable V-beams, the micro torsion and focusing deformable mirror and micro lenses.

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Direct Additive Manufacturing of Ceramic Components

Abstract
In stereo lithographic additive manufacturing, two dimensional cross sections are created through photo polymerization by UV laser drawing on spread resin paste including ceramic nano particles, and three dimensional composite models are sterically printed by layer lamination. An automatic collimeter was equipped with the laser scanner to adjust beam diameter. Fine or coarse beams could realize high resolution or wide area drawings, respectively. As the row material, nano meter sized ceramic particles were dispersed in to photo sensitive liquid resins at 50 % in volume fraction. These materials were mixed and deformed to obtained thixo tropic slurry for 15 min at700 and 300 rpm of rotation and revolution speeds, respectively. The resin paste was spread on a glass substrate at 100 μm in layer thickness by a mechanically moved knife edge. An ultraviolet laser beam of 355 nm in wavelength was adjusted at 50 μm in variable diameter and scanned onthe spread resin surface. Irradiation power was increased at 1 W for resin dew axing and powder sintering through heating by ultraviolet ray propagations, resonations and absorptions in the paste materials. In this investigation, micro lattice patterns composed of titania were fabricated tomodullate electromagnetic waves in terahertz frequency range. The components especially called photonic crystals as artificial materials to exhibit band gaps in transmission spectra through wave diffractions in electromagnetic fields.

Keywords
Additive Manufacturing, Laser Lithography, Nano particles Sintering

Biography
Soshu Kirihara is a doctor of engineering and a professor of Joining and Welding Research Institute (JWRI), Osaka University, Japan. In his main investigation “Materials Tectonics” for environmental improvements of “Geo technology”, multi-dimensional structures were successfully fabricated to modulate energy and materials flows effectively. Ceramic and metal components were fabricated directly by smart additive manufacturing, design, and evaluation (Smart MADE) using high-power ultraviolet laser lithography. Original stereo lithography systems were developed and a new start-up company “SK-Fine” was established through academic-industrial collaboration.

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Advances in Considering the Propellant-less Propulsion as Electromagnetic-Gravitational Propulsion

Abstract
The so called propellant-less propulsion is a new research direction which targets generation of propulsion force without using a propellant. This concept sometimes called EmDrive or Resonant Cavity Thruster affirms that a propulsion force should appear when microwaves are confined inside a metallic cone-trunk. Obviously, this concept violates the Law of Momentum Conservation because during the process no propellant is accelerated and the third law of Newton which states that for any action there is an opposite reaction.

In 2017, the author of this paper published a physics article [1] where the so called 'Theorem of Conversion of Electromagnetic Waves in Gravitational Waves' was demonstrated. That theorem states mainly that ' During multiple reflections of electromagnetic waves between parallel reflective surfaces, gravitational waves are generated perpendicular to the reflective surfaces' . This law is the basis of the 'Theory of Electromagnetic Gravitational Spacecraft' [2] which demonstrates the principles, design and technology of these kind of spacecraft. The mentioned type of spacecraft uses a 'Gravitational Propulsion' instead of 'Law of Momentum Conservation', i.e., the gravitational radiation generated on the board of spacecraft attracts the spacecraft to the desired direction. In the present paper, firstly it is done a short review of EmDrive, then of the 'Theorem of Conversion of Electromagnetic Waves in Gravitational Waves' and finally of the 'Electromagnetic Gravitational Spacecraft' showing that the notion of propellant-less propulsion should be substitute with Electromagnetic-Gravitational-Propulsion.

Keywords
Gravitational propulsion, Gravitational wave generation

References
[1] C.Sandu, D. Brasoveanu, On the Theoretical Possibility to Generate Gravitational Waves Using Electromagnetic Waves, ISSN2347 - 3487, Volume 13 Number 2, Journal of Advances in Physics
[2] C.Sandu, D. Brasoveanu, Sonic-Electromagnetic-Gravitational–Spacecraft, American Institute of Aeronautics and Astronautics-Space 2007Conference-September 18, 2007-California, USA paper no. AIAA 2007-6203

Biography
Constantin SANDU- Aerospace Engineer, PhD - Project Manager at COMOTI-Bucharest;
Participated in multiple R&D aerospace projects with: Airbus, SAFRAN, Rolls-Royce, Avio, DLR, NLR, Politechnico di Milano, MTU, ISVR, ONERA, Politehnica University of Bucharest, Faculty of

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The most important papers are related to: Electromagnetic-Gravitational Propulsion of spacecraft; Noise reduction at aircraft; Turbomachinery.

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Prospects for the use of Perforation to Control the Flow around Aircraft

Abstract

Perforation of the streamlined surfaces of aircraft can be used to control it`s aerodynamics and motion dynamics.Below is one example of perforationusage. The flow around aircraft with a stabilizer (skirt), as a rule, is accompanied by flow separation, which leads to the buildup of the aircraft [1]. One way to prevent this undesirable phenomenon is through perforation of the stabilizers surface. The paper considers the flow around aircraft with solid and perforated stabilizing skirts (Fig. 1) and various types of the head part: endblunted (Fig. 1, a) and spherically blunted (Fig. 1, b).

The aerodynamic characteristics of aircraft models are determined experimentally in a subsonic wind tunnel at an oncoming flow velocity V = 10…25 m/s and angles of attack α = 0..30º.Figure 1, c shows the longitudinal force coefficient of the aircraft depending on α.Perforation of the stabilizer leads to the appearance of additional pressure acting on the surface inside the holes, and to a slight increase in bottom pressure due to mass transfer. As a result, perforation makes it possible to obtain greater cx over the entire range of α.

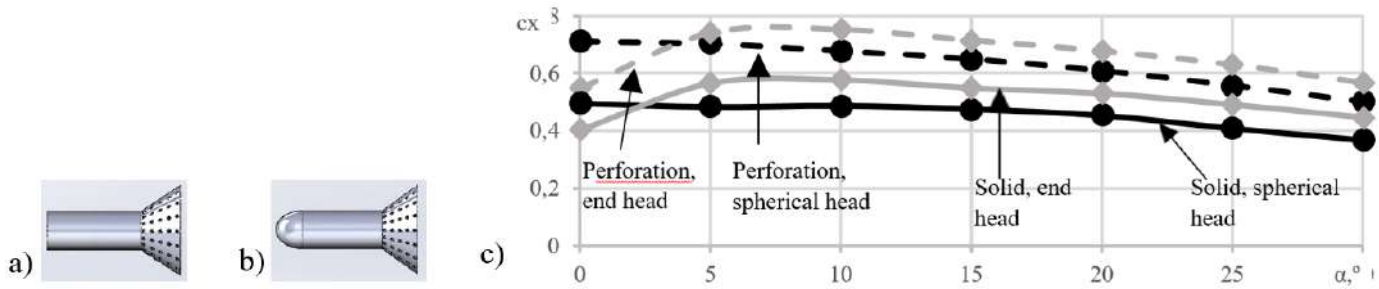

Figure 1. Aircraft with a perforated skirt and aerodynamic coefficients

The perforation of the stabilizers makes it possible to avoid the buildup of the aircraft due to the elimination of flow separation and stabilization of the flow in the near wake. Numerical simulations in the FlowVision computing package confirm numerous experimental data.

Keywords

Perforation, aerodynamic skirt, subsonic flow

References

[1] V. T. Kalugin and V. Yu. Sobolev, Bulletin of the Bauman Moscow State Technical University. Ser. “Engineering”. Peculiarities of Subsonic Separated Flow around Blunt Aircraft with Disk Stabilizers, 41 – 49, (2006).

Biography

Kalugina Maria Denisovna – post-graduate student of Bauman Moscow State Technical University, Hirsch index –1, number of publications in Scopus –8.

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Enhanced Supersonic Annular Nozzle Performances:Analysis OfFlow Separation And Side Loads Phenomena

Abstract

This paper presents newly developed contours of axisymmetric supersonic nozzles, to accelerate the supersonic flow to the desired Mach number. This nozzle gives a parallel and uniform flow at the exit. It is called: The Conical Annular Nozzle (CAN). Its form represents a profiled central body and an external wall for the redress of the flow, to improve the aerodynamic performance compared to the Minimum Length Nozzle (MLN)and the Best Performance Nozzle(BPN). The study is performed at a high temperature. Our objective is to improve the performance both by the increase of the exit Mach number and the thrust coefficient and by the reduction of the design complexity of the nozzle while conserving the same throat area for the three nozzles mentioned above. The design is executed by the Method Of Characteristics. The validation of the results is influenced by the convergence of the ratio of the critical sections calculated numerically for a given discretization with that given by the theory. If a rocket engine is operated under strongly over-expanded conditions compared with the ambient pressure at a considerably higher than the nozzle exit pressure, the flow separates from the wall and can lead to considerablelateral forces,(sideloads). These loads are reduced in this new nozzle design. The results are compared, at first, with the MLN, since it is currently used in the aerospace propulsion domain. In addition, the results are also compared with theBPN, for further results validation. All the obtained results depend on four parameters which are: the exit Mach number, the stagnation temperature, the chosen mesh in characteristics, and the radius of the central body.

Keywords

Flow separation, side-loads, High Temperature, Cylindrical Annular Nozzle, Method Of Characteristics.

References

[1] Emanuel G., "Gasdynamic: Theory and Application," AIAA Educational Series, New York, 1986.
[2] Emanuel G. and Argrow B. M., "Comparison of Minimum Length Nozzles," Journal of FluidEngineering, Transaction of ASME, Vol. 110, PP. 283-288, 1998.
[3] M. Roland rydén, T. Alziary de Roquefort, G. Hagemann, P. James, T. Kachler, P. Reijasse, R. Schwane, " 4th International Conference on Launcher Technology space launcher liquid Propulsion"- Liege (Belgium)3-6 December 2002.
[4] CFD-FASTRAN. Theory manual version,2003.
[5] Ostlund, J., Damgaad, T., and Frey, M., "Side-load phenomena in highly Over-expanded rocket

nozzle''Journal of propulsion and power, Vol .20, No.4, pp.695-704, 2004.
[6] Ostlund, J., and Klingmann, B., ''Supersonic flow separation with application to rocket engine nozzle'' Applied mechanics reviews, Vol. 58, pp. 143-176 May 2005.
[7] Zebbiche T. and Youbi Z., "Supersonic two-dimensional minimum length nozzle design at high temperature. Air application," Chinese Journal of Aeronautics, Vol. 20, N° 1, PP. 29–39, 2007.
[8] Zebbiche T. and Youbi Z., "Effect of stagnation temperature on the supersonic flow parameters with an application for air in nozzles," The Aeronautical Journal, Vol. 111, N° 1115, PP. 31–40, 2007.
[9] Sutton G. P. and Biblarz O, "Rocket Propulsion Elements," 8èmeedition, John Wileyand Sons, 2010.
[10] Boun-jad M., ZebbicheT.andAllali A, "Gas effect at high temperature on the supersonic nozzle conception," International Journal of Aeronautical and Space Sciences, Vol. 18, N° 01, PP. 82-90, 2017.
[11] Walid Hamaidia and all ''Performance improvement of supersonic nozzles design using a high-temperature model'' Proc IMechE Part G: J Aerospace Engineering, Vol 233(13) Paper 4895-4910, 2019.

Biography

HAMAIDIA Walid was born in Tebessa, Algeria, on 06 February1984. He graduated as an engineer in aeronautical engineering from the Aeronautics Institute of Blida, Algeria, in 2009, and the M.Sc. in Aeronautics Sciences from the SAAD DAHLAB University of Blida-1, Algeria, in 2014. He received his Ph.D. (with honors) in aeronautical engineering at the aeronautics department of SAAD DAHLAB Blida-1 University on 3rd July 2020. At present, he is a PhD. in the Superior School of Aeronautical Technics, Algiers, Algeria. His current research activities include Gas dynamics,Fluids mechanics, Rocket propulsion, and optimization theory.

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CFD Analysis and Optimization of Morphing Devices

Abstract

In the frame of the GRETEL Project, CFD analysis und optimization of morphing devices was performed. In the Wing design background and specifications task, the preliminary requirements for the scaled down structure were set, in terms of full-scale laminar wing geometry, aero-elastic wing model, LC&A devices, technical specification for WT testing. Furthermore, the characteristics of the wind tunnel for performing the wind tunnel tests were collected and considered in the wing tunnel scale model design. Based on the specifications, the full scale wing was scaled down to the wing tunnel model size ensuring that the wing static stiffness and dynamic response is representative of the actual wing deformation at specified flow conditions. This included a wing WT design, by scaling down to the wing tunnel model size of the full-scale laminar wing geometry, equipped with LC&A morphing devices, ensuring that the wing model deformations is representative of the actual wing deformation at specified flow conditions. More specifically, the wing box and its internal structure (spars, ribs, and lower skin) were designed, aiming to keep the mass and stiffness distributions of the full scale wing. Special emphasis was given to the skin deflections, which is driven by appropriately selected actuators placed in the wing box structure, aiming to deform the model wing in the way the full wing deforms in the same flight condition. To support the WT model design, the structural and aeroelastic design was undertaken for the scaled model. Mechanical design and stress analysis for the estimation of the wing model deformation were carried out in accordance with WT requirements and in a closed loop with activities for the integration of the active adaptive devices with the designed NLF flexible wing. Parametric Finite Element Models of different levels of detail were created for the scaled wing design, starting from simple 'stress check' FE models, up to very detailed FE models aiming to accurately represent the functions and skin deformations of all wing morphing devices, i.e. droop nose, morphing TE flap and morphing wing tip.

The Poster will give an Overview on the objectives and findings of the CFD analysis und optimization of morphing devices tasks in the frame of the GRETL Project.

Keywords

Wing design, Wing scaled model design, Structural and aeroelastic design

Biography

AK, Senior Manager Technology & Innovation, did my diploma in Germany, Austria, China and Vietnam in European studies, since 12 years at Cap and R&D responsible

Funding

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Overview on the Objectives and Findings of the GRETEL Project

Abstract
Morphing structures allow a shape change without the generation of discontinuities, in other words without aerodynamic gaps. Past research in this area usually focused either on aerodynamic performance or system integration, with relatively little attention on the strict requirements imposed by the long lifetimes and extreme environmental conditions the structural materials are exposed to. Therefore, morphing structures have not yet made their way into serial production aircraft. The Clean Sky 2/ GRETEL project aims to change this.

The activities aim to mature the Technology Readiness Level (TRL) up to 6 and drastically de- risk the integration of the investigated solutions on future products, effectively resulting in reducing the direct operating costs for the airlines and minimizing the impact on the environment. GRETEL aim is to develop and demonstrate the technologies required to improve aerodynamic efficiency and environmental footprint of aircraft life cycle. In order to address the specific challenges, the project followed the subsequent technical development objectives:

- To design a large scale (1:3) Natural Laminar Flow (NLF) flexible wing model of a future regional aircraft that will feature innovative active devices for increased aerodynamic efficiency.

- To manufacture all components of the wing model and assemble them observing the provided specifications in dimensions and other tolerances. The wing model apart from the active devices (droop nose, morphing trailing edge, morphing winglet) will integrate the necessary sensors for the subsequent wind tunnel testing.
- To perform Ground Vibration Tests in order to validate the aero elastic predictions and ensure the safety of the model during the wind tunnel testing.
- To assist the wind tunnel testing by providing the experimental support definition, the test planning and data analysis and reporting.

The Poster will give an Overview on the objectives and findings of the GRETL Project.

Keywords
Turboprop Experimental Laminar Flow WT-Testing

Biography
Martin Schüller studied micro technology at TU Chemnitz and graduated in 2007. He then worked for over 12 years as a scientist at the Fraunhofer (ENAS) in the field of micro fluidics. He is currently an independent scientist and project manager at TriSiTec UG (haftungsbeschränkt).

Funding

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Virtual Presentations

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Adaptive Fault Diagnosis and Fault Tolerant Control with Flight Control Applications

Abstract
Based on the background of the flight control systems, this talk focuses on the topic of adaptive fault accommodation for complex dynamic systems, and introduces a series of results of fault detection, estimation and accommodation for continuous time, hybrid systems and multi-agent systems. Their applications on the hot issues of satellites, near space vehicles, helicopters are investigated. Some perspectives along this direction are provided.

Biography
Bin Jiang received the Ph.D. degree in Automatic Control from Northeastern University, Shenyang, China. He had ever been postdoctoral fellow, research fellow, invited professor and visiting professor in Singapore, France, USA and Canada, respectively. Now he is a Chair Professor of Cheung Kong Scholar Program in Ministry of Education and Vice President in Nanjing University of Aeronautics and Astronautics, China. He has served as Subject Editor of Int. J. Control. Automaton and Systems, Associate Editor or Editorial Board Member for a number of journals such as IEEE Trans. On Cybernetics, IEEE Trans. On Neural Network and Learning Systems, IEEE Trans. On Control Systems Technology, etc. He is a Fellow of IEEE, Chair of Control Systems Chapter in IEEE Nanjing Section, a member of IFAC Technical Committee on Fault Detection, Supervision, and Safety of Technical Processes. His research interests include intelligent fault diagnosis and fault tolerant control and their applications to helicopters, satellites and high-speed trains.

He is the author of 8 books and over 100 referred international journal papers. He won National Natural Science Award of China.

Prof. Eric Cheng

Electric Vehicle Laboratory, Department of Electrical Engineering, The Hong Kong Polytechnic University

Energy Management for Electric Vehicle: Present and Future

Abstract

Super capacitors, Fuel cells, and batteries are the major energy storage units for Electric vehicles (EV). The performance of an EV is highly governed by its performance. The challenge is not only to develop very high-density energy storage, the safety, dynamics, power conditioning, and charging method are also important research and development areas. The commonly used hydrogen fuel cell and metal-air fuel cell could be important future energy storage for mobility. Its performance and potential as compared with the other high-performance battery is an interesting area for exploration.

Besides the Li-ion battery, there are many other newly emerging batteries such as new forms of Li-ion battery and flow batteries. Also, the super-capacitor usually works in parallel with the battery. The associated application to electric vehicles, and also their power conditioning is now a hot research topic. The battery management system is one of the key technologies to make the battery to be successful. This technology is now being investigated for use in the second life battery obtained from the retired vehicles. In this century, electric vehicle research is also extended to the electric vessel. The opportunity of the electric vessel also plays an important role in smart mobility and smart city.

The talk will discuss the recent and future developments in energy management including fuel cell and battery technology and the associated electric engineering research for the application to electric mobility.

Biography

Prof Eric Cheng obtained his BSc and PhD degrees both from the University of Bath in 1987 and 1990 respectively. Before he joined the Hong Kong Polytechnic University in 1997, he was with Lucas Aerospace, United Kingdom as a Principal Engineer and led a number of power electronics projects.

He is the electrical designer for the Hong Kong 1st commercial electric vehicle in Hong Kong. He is also the designer for the 1st charging network in Hong Kong. He received the numerous awards related to electrical engineering, energy and automotive. He has published over 500 papers and 7 books. He has over 100 interviews by media on his research and development. He is now the professor and director of Power Electronics Research Centre of the university. His research interests are all aspects of power electronics, Power Quality, Renewable energy, Motor drives, Energy Saving, EMI, high speed rail, Electric Vessel, Electric Vehicle and Automotive advanced components. He is the recipient of the international award in Seoul International Invention Fair 2015 Gold prize for his contribution in super-capacitor to electric vehicles, 2016 iCAN Gold Medal for his contribution in

active suspension, and Gold Award of Hong Kong Innovation and Technology in 2017 and Geneva's Invention Expo Silver Award for his contribution in antilock braking system, in 2021. Prof. Cheng is a fellow of IEEE and IET

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On-the-Fly Double Reduced Model for Large-Scale Stress Constrained Topology Optimization

Abstract

Mechanical stress is a critical factor that affects performance, service life, fatigue resistance and safety of structural components, and is inarguably an important design criterion. Traditional topology optimization formulations [1] typically do not consider stress constraints, which could result in the phenomenon of high stress concentrations, leading to a final "optimized" design that all too often fails to meet real engineering requirements. In order to handle these problems, researchers have put forward a variety of effective methods to deal with them. The main hindrances are the solution of large-scale linear systems during the FEA analysis (equilibrium equation) in each iteration, as well as the sensitivity analysis of stress constraint functions due to the non self-adjoint nature.

In this work, we present a paradigm for large-scale stress-constrained topology optimization problems,where we build a multi-gridapproach using an on-the-fly Reduced Order Model(ROM) [2] and the p-norm aggregation function [3], in which the discrete reduced-order basis functions (modes) are adaptively constructedfor both the primal and dual problems. In addition to reducing the computational savingsdue to the ROM, we also address the computational cost of the ROM learning and updating phases. Both reduced-order bases are enrichedaccording to the residual threshold of the corresponding linear systems, and the grid resolution is adaptively selected based on the relative error in approximating the objective function and constraint values during the iteration. The tests on 2D and 3D benchmark problems demonstrate improved performance with acceptable objective and constraint violation errors. Finally, we thoroughly investigate the influence of relevant stress constraint parameters such as the coagulation factor, stress penalty factor, and the allowable stress value.This work is supported by the Natural Science Foundation of Shaanxi Province, China (Grant No.2021JM-043).

Keywords

Stress constraints, Topology optimization, PCA, ROM, Adjoint equations

References

[1] O. Sigmund. A 99-line topology optimization code written in Matlab[J]. Structural and Multidisciplinary Optimization, 21(2):120-127, (2001).

[2] M. Xiao, D. Lu, P. Breitkopf, B. Raghavan, W. Zhang, S. Dutta. Multi-grid reduced-order topology optimization. Structural and Multidisciplinary Optimization, 61, 1-23, (2020).

[3] P. Duysinx, L. Van Miegroet, E. Lemaire, et al. Topology and generalized shape optimization: Why stress constraints are so important[J]? International Journal for Simulation and Multidisciplinary

Design Optimization, 2008, 2(4):253-258.

Biography

Manyu Xiao has completed her PhD and post-doctoral study in Advanced Mechanics from the Université de Technologie de Compiègne (UTC) in France. Since 2012, she works as an associated professor at Northwestern Polytechnical University in Xi'an, P.R. China. She is a member of the joint French-Chinese research group "Virtual Prototyping and Design". Her interest research includes model reduction, POD, multi-fidelity co-kriging, Machine Learning, Large scale topology optimization. Until now, she has herself authored/co-authored over 50 peer reviewed journal articles, book chapters.

Professor. David Moss

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Kerr Optical Frequency Micro Comb Chips for Ultrahigh Bandwidth Microwave and RF Aerospace Applications

Abstract

Optical frequency combs earned the 2005 Nobel Prize in Physics with their unprecedented ability to unify the microwave and optical frequency regimes for the first time. They have already revolutionized many fields of science and technology, from optical clocks to spectroscopy, astro-combs, optical lidar and much more. Kerr microcombs offer the promise of achieving the full capability of OFCs but in integrated microchip form. My talk will focus on our work on ultrahigh bandwidth applications of Kerr optical microcombs to optical neural networks, optical data transmission and microwave and RF photonics. Convolutional neural networks (CNNs) are a powerful category of artificial neural networks that can extract the hierarchical features of raw data to greatly reduce the network complexity and enhance the accuracy for machine learning tasks such as computer vision, speech recognition, playing board games and medical diagnosis. Optical neural networks can dramatically accelerate the computing speed to overcome the inherent bandwidth bottleneck of electronics. We demonstrate a universal optical convolutional accelerator operating at 11 Tera-OPS/s (TOPS) on 250,000 pixel images, and a deep optical CNN, achieving successful recognition of full 10 digits. We also report world-record high data transmission over standard optical fiber from a single optical source, at 44.2 Terabits/s over the C-band. We achieve error free transmission across 75 km of standard optical fiber in the lab and over an installed metropolitan optical fiber network. Our work demonstrates the potential of optical Kerr micro-combs for the most demanding practical optical signal processing and communications applications.

Biography and Research Interests

David J. Moss is Director of the Optical Sciences Centre at Swinburne University of Technology in Melbourne, Australia, since 2016. He was with RMIT University in Melbourne, 2014-16, the University of Sydney 2004 - 14 and was a senior manager and scientist with JDS Uniphase in Ottawa Canada from 1998-2003. From 1994-98 he was a Senior Research Fellow with the Optical Fiber Technology Centre at Sydney University prior to which he was a visiting Scientist with Hitachi Central Research Laboratories in Tokyo, Japan,1992-94. From 1988-92 was with the National Research Council of Canada in Ottawa. He received his PhD from the University of Toronto in Physics and BSc from the University of Waterloo. He won the 2011 Australian Museum Eureka Science Prize and Google Australia Prize for Innovation in Computer Science. He is a Fellow of the IEEE Photonics Society, the OSA (now the Optica Society) and the SPIE (International Photonics Society). His research interests include optical microcombs, integrated nonlinear optics, quantum optics, microwave photonics, optical neural networks, optical networks and transmission, 2D materials including graphene oxide for nonlinear optics, optical

signal processing, nanophotonics, biomedical photonics for cancer diagnosis and therapy, and other areas.

Li Zixuan
Ningbo University, China

Numerical and Experimental Analysis on Multi-Pass Cold Spinning of Super alloy GH3030

Abstract

As the most important part of aeroengine, the mainstream manufacturing method of sheet metal casing is hot spinning process. The superalloy parts have good plasticity and high material elongation at high temperature (usually above 800 ℃), but the surface quality of the parts is poor, so it needs to be turning to remove the oxide scale, so the energy consumption is large and the production cost is very high. Due to the poor plasticity of the superalloy at room temperature, the cold spinning process requires high equipment force, and it is very easy to crack. Therefore, the influence mechanism of die parameters and process parameters on the cold spinning process of superalloy is not clear, and the design of roller trace still relies on the experience of workers for a long time, lacking reasonable process guidance. Therefore, in this research, the unequal wall thickness cylindrical sheet metal casing of superalloy (GH3030) is taken as the research object, and the conventional spinning and the power spinning are taken as the research process. Starting from the two technical routes of macro and micro aspects, combined with the parametric modeling of the roller trace and the multi-step simulation, the cold spinning mechanism is revealed, a more reliable optimization method of process parameter is design.To avoid the cracking and wrinkling phenomenon in the cold spinning process, the microstructure evolution law and residual stress distribution law of the cold spinning process are revealed.

Biography

Li Zixuan has completed his Ph.D. from Ningbo University, China. He has completed his postdoctoral studies at Taiyuan University of Technology, China. He is now associate professor at Ningbo University, China. He has published more than 20 papers.

Chua Kian Jon

Department of Mechanical Engineering; National University of Singapore

Air-conditioning, dehumidification, process heating, refrigeration, district cooling, co-generation/tri-generation, thermal water desalination

Game-Changing Air Conditioning Technologies for Better Sustainability

Abstract

Air conditioning is essential to sustain thermal comfort for both indoor and outdoor environments, particularly for hot and humid climates. In tropical climates, due to extreme amount of water vapour in the atmosphere, the energy consumed by heating, ventilation and air-conditioning (HVAC) often exceed 50% of the total energy consumption of a building. This significant figure imposed on present vapour compression air conditioners to remove both sensible and latent heat loads. Accordingly, there is tremendous potential to improve the overall efficiency of the air-conditioning systems in buildings by decoupling sensible and latent cooling. This talk primarily focuses on recent innovative cooling/dehumidification technologies and strategies when implemented correctly willmarkedly improve the energy efficiency of air conditioning – promoting sustainability in many metropolitan cities.

It talk focuses on recent research advancements related tosensible cooling and air dehumidification. Several key technologies are presented, namely, dew-point evaporative cooling, membrane dehumidifier, polymer based super-absorbents and nano-hybrid Metal-Organic Frameworks. It furtherhighlights their most recent advancements, performances, and provides key insights on their global energy and sustainability impacts when they are widely deployed at large-scale district cooling levels.

Biography

Dr Chua Kian Jon is currently an Associate Professor with the Department of Mechanical Engineering, National University of Singapore. He has been conducting research on air-conditioning, refrigeration, and heat recovery systems since 1997. He has conducted both modelling and experimental works for specific thermal energy systems. These include dehumidification, cooling, heat pumping, compact heat exchangers and refined temperature/humidity control. He is highly skilled in designing; fabricating; commissioning and testing many sustainable energy systems to provide for heating, cooling and humidity control for both small and large scale applications. He has more than 200 international peer-reviewed journal publications, 6 book chapters and two recent monographs on advances in air conditioning (https://www.springer.com/gp/book/9789811584763 and https://www.springer.com/gp/book/9783030808426). He was highlighted to be among the top 2% of global energy scientists based on Elsevier's database,1% of scientists in the world by the Universal Scientific Education and Research Network, top 0.3% in the Stanford list of energy researchers. He has been elected to several fellowships including Fellow of Royal Society and Fellow of Energy Institute.His works has garnered more than 11,400 over citations with a current h-index of 55. Further, he owns more than 15 patents related to several innovative cooling and dehumidification systems. He is the Principal Investigator of several multi-million competitive research grants. Additionally, he has been awarded multiple local, regional, and international awards for his breakthrough research endeavours.

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Y. L. Jiang[1]

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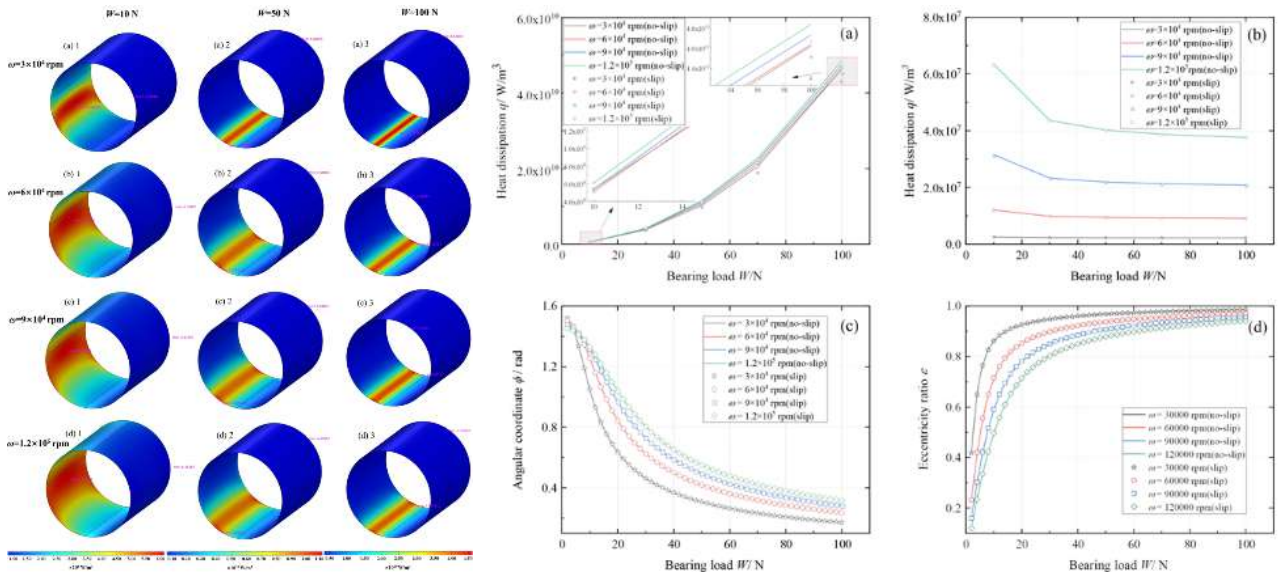
Influences of Slip Effect on Viscous Dissipation Heat of Gas-lubricated Journal Bearings

Abstract

The viscous dissipation heat closely relates to the thermal stability and durability of gas-lubricated journal bearing (GLJB), while, slip effect is generally inevitable in its high-speed operating condition, however, the exploration on influences of slip effect on viscous dissipation heat is relatively less. Thus, this paper aims to carry out an analytical study of them.The distributions of lubricant gas viscous dissipation heat versus different operating parameters are studied, which is realized by combining the compressible Reynolds equation with the viscous dissipation equation, and solved by the finite element method. The gas slip effect reduces the maximum and minimum viscous dissipation heat peaks. With bearing speed increasing, the higher viscous dissipation heat and pressure zone rapidly magnifies. Under larger bearing load, the higher viscous dissipation heat zone is concentrated. This paper provides fruitful new inside view in the study of viscous dissipation heat with slip effect, the analysis process and relevant results are beneficial for designers in promoting working performance of GLJB.

Keywords

Viscous dissipation heat, Slip effect, Gas-lubricated journal bearing



References

L.S.Andrés, B. Rodríguez, J. Eng. Gas. Turb. Power. ASME., 142, 111004, (2020).
D. Shin, J. Yang, X. M. Tong, A. Palazzolo, J. Tribol.-T. ASME., 143, 031803, (2021).

Biography

Mr. Yulong Jiang is a candidate for Ph.D.whostudies flow and thermal characteristics of GLJB and has published five SCI papers (including three first-author papers)with IF >22.5 in total.

Dr. Zhenqian Chen is a professor at Southeast University, who engaged in heat and mass transfer, refrigeration technology, et al.He has published more than 200 high-level papers, including more than100 SCI papers, andhas been authorized 25 invention patents.He has presided over 50 projects, including 2 international cooperation projectsand 7 NSFC projects. He is the member of high education assessment committee of MoHURD of China,ASHRAE and ASME. He has won the 2020 Minkowycz Award for the Best Paper of IJHMT.

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Semi Analytical Approaches in Moving Load Problems with a Focus on Railway Dynamics: Critical Velocity and Instability of Moving Inertial Objects

Abstract

In this presentation, a new form of semianalytical results related to inertial objects that are traversing longitudinally homogeneous infinite structures, introduced in previous author's works [1-3], is used to analyze plane models of railway track composed of a guiding structure in form of a beam and a supporting structure composed of discrete masses, springs, and dampers. The aim of these analyses is determination of critical velocities of a moving force and of the onset of instability of moving masses or oscillators. Additional focus is placed on the connection between the lowest critical velocity and the onset of instability and on the dynamic interaction between proximate moving inertial objects.

The new semianalytical results are obtained for infinite structures, but in addition to these derivations, equivalent finite models are presented and solved in order to provide easy validation. For such structures, the eigenmode expansion method is used and therefore the natural frequencies and orthogonality conditions are derived. Furthermore, due to the coupling of modal equations, a rearrangement of the terms involved is introduced to save computational time. Connection to the critical velocity between both approaches is also derived, [4].

All results, both from finite models and from infinite models, are presented as much as possible analytically using dimensionless parameters, and therefore can be used directly for several combinations of input data.

One of the most important conclusions is that for two moving proximate masses, the external viscous damping coupled with the dynamic interaction can shift the onset of instability deeply into the subcritical range of velocities [5-6].Such conclusion is important for railway track design. Particularly, since the general guidelines are directed to avoiding the critical velocity, it is important to know under what circumstances the onset of instability of two proximate moving inertial objects can occur in the subcritical velocity range. In addition, it is also important to know how the dynamic interaction between the guiding structure and foundation affects the lowest critical velocity [7-9].

Keywords

critical velocity, moving masses, semianalytical solution, dynamic interaction, onset of instability, contour integration.

References

[1] Z. Dimitrovová, Int J Mech Sci,127, 142–162,(2017).
[2] Z. Dimitrovová, Int J Mech Sci,144, 283-311, (2018).
[3] Z. Dimitrovová,J Sound Vib, 438, 257-290, (2019).
[4] Z. Dimitrovová, A.S.F. Rodrigues,AdvEngSoftw, 50, 44–56, (2012).

[5] Z. Dimitrovová, Appl Math Model 100, 192-217, (2021).
[6] Z. Dimitrovová, Int J Mech Sci 217, 107042, (2022).
[7] Z. Dimitrovová,J Sound Vib, 366, 325–342,(2016).
[8] Z. Dimitrovová,Int J Solids Struct, 122–123, 128-147, (2017).
[9] Z. Dimitrovová,Meccanica, 55(12), 2353–2389, (2020).
[10]

Biography

Zuzana Dimitrovová has degree in Civil Engineering (1983) and Mathematical Analysis (1990) from the Czech Technical University and Charles University in Prague; and Ph.D. in Mechanical Engineering (1997) fromthe Instituto Superior Técnico, University of Lisbon. She has authored and co-authored a textbook and more than a hundred scientific publications in international journals, books and conference proceedings; together with reports and other publications, this completes almost two hundred works. She has edited four conference proceedings andtwelve special issues in international journals. She is an associate editor of the Journal of Vibration Engineering and Technologies and a member of the editorial board of threeother international journals. She has participated in several research projects and chaired two international conferences (11th ICOVP-2013, VETOMAC XIV-2018), another will be held (12th WMVC-2022). She integrates several scientific and steering committees of international conferences and has organized a number of Mini-Symposia. She participated several times in the evaluation of European projects, supervised one PhD and several MSc students. From 1985 to the present, she has taught at four different institutions, currently at the NOVA School of Science and Technology. She is also an IDMEC/LAETA researcher at the Instituto Superior Técnico. Her current research interests are in structures subjected to moving loads. She coordinates a postgraduate course on Railway Rehabilitation.

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Joining Thick Plates with High Efficiency by Advanced Non-Consumable Gas Shielded Arc Welding

Abstract

Non-consumable gas shielded arc welding technologies have been recognized as most reliable and stable choices in the key manufacturing industries, such as Aerospace, nuclear power plants, and other important industries. For middle thick and thick plates, PAW (plasma arc welding) and narrow gap GTAW (gas tungsten arc welding) show high efficiency than conventional multi-pass multi-layer welding processes. Structures with middle-thickness (4mm-10mm) can be welded by PAW with full penetration in a single pass without any groove. The key weld pool and inside keyhole behaviors have been investigated via visual sensing and intelligent control. The developed closed-loop control system obtained fully penetrated butt joints and stable processes. For thick plates (>10 mm), the narrow gap or ultra-narrow gap GTAW could achieve narrow weld seams with only one pass in each layer, which significantly decreased required welding procedures and increased the efficiency.A novel rotating-tungsten narrow-gap GTAW process was proposed based on aspecially designed non-axisymmetric and rotating tungstenelectrode. The produced special rotating arc periodically burned from the left sidewall,bottom pool, and the right sidewall. Itsuccessfully solved the keyincomplete fusion problem on sidewalls and ensure a uniform and smooth weld appearance.

Keywords

Thick plates welding; plasma arc welding; narrow-gap GTAW; high efficiency;

References

[1] Shi Y H, Cui S W, Zhu T, et al. Microstructure and intergranular corrosion behavior of HAZ in DP-TIG welded DSS joints. J. Mater. Process. Tech., (256): 254 [9],(2018)

[2] Panwisawas C, Perumal B, Ward R M, et al. Keyhole formation and thermal fluid flow-induced porosity during laser fusion welding in titanium alloys: experimental and modelling [J]. Acta. Mater., (126): 251 (2016)

[3] Cai, X., Fan, C., Lin, S., Ji, X., Yang, C., and Guo, W.Effects of shielding gas composition on arc propertiesand wire melting characteristics in narrow gap MAG welding. JMater Process Tech, 244: 225–230.(2017).

[4] Nilsen, M., Sikström, F., Christiansson, A. K., and Ancona, A. Vision and spectroscopic sensing for jointtracing in narrow gap laser butt welding. OptLaser Techno, (96): 107–116.(2016).

Biography

Prof. Chuanbao Jia, Tang Scholar, Deputy Director of the Institute of Materials Joining(IMJ) in Shandong University, Council member of China Welding Society (CWS), Senior member of Chinese

Mechanical Engineering Society (CMES). He has been devoted to research on high-efficiency/ special arc welding and additive manufacturing process sensing, control and numerical simulation. As the PI, Prof. Jia has been granted 3 NSFC projects and 1 National Cooperative projects, etc. He published more than 40 research papers and was authorized 16 patents. Also, Prof. Jia contributes as areviewer of more than 20 journals, including Welding Journal, Journal of Materials Processing Technology, Materials Design, etc.

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