International Symposium On Aircraft Technology, MRO & Operations

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Le Quy Don Technical University, Hanoi, VIETNAM

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International Sustainable Aviation and Energy Research Society

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Message from the Symposium Chairs

It is our great pleasure to invite you to the International Symposium on Aircraft Technology, MRO & Operations (ISATECH) which will be held in an Online/Hybrid Mode on August 24 – 26, 2023.

Given the significance and the fast growth of the aerospace sector, this symposium intends to make a positive contribution to the research in the field of aerospace science and technology. ISATECH, an international, multi-disciplinary symposium, aims to address current issues in the aerospace fields such as aircraft design and optimization, aerospace propulsion systems, aircraft guidance and control, state-of-the-art manufacturing, MRO, air transportation operations, use of artificial intelligence in aerospace, clean energy and emission reduction, aerospace legislation, and so on.

The ISATECH'23 provides a unique opportunity for contributors dealing with Aircraft Technology, MRO, and Operations to exhibit their solutions. The conference offers a platform for exchanging insights about the latest trends in aircraft design, propulsion systems, contemporary manufacturing, aircraft maintenance, repair and overhaul market development, and maintaining airworthiness to provide innovative solutions to the challenges the aviation industry is facing.

As we are in an era in which there is continuous progress in aviation, we would like to invite researchers, scientists, engineers, practitioners, policymakers, and students to the International Symposium on Aircraft Technology, MRO & Operations (ISATECH'23) to exchange information and experience, present best practices, new technologies, and developments, and discuss future research directions, strategies, and priorities.

ISATECH also aims to promote a broad range of topics involving the electrification of aerial vehicles such as design of all-electric aircraft, electric propulsion, electric generation and storage in aerial vehicles, and so on. ISATECH will include several keynote presentations, specialized sessions, and oral and poster presentation sessions from the participants on different subjects related to electric use in aviation.

We look forward to welcoming you to this remarkable event in August 2023.

Yours Sincerely,

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CONTENTS

KS01
Visualization on Supercritical/Transcritical CO_2 Jet and Boundary Flow

Lin Chen, Professor

Institute of Engineering Thermophysics, Chinese Academy of Sciences, China

Abstract: The physical processes of supercritical and transcritical jets and boundary heat transfer flow with local sources have been found in a wide series of applications such as aerospace engineering, power conversion and propulsion, high speed flow, fuel injection in many high-pressure combustion devices including diesel engines, gas turbines and liquid rocket engines, etc. Quantitative measurement of transcritical jet under the influence of high-pressure effect and transient effect is the key issues in such processes. In this talk, an improved system with high temporal and spatial resolution has been realized by pixelated-array masked method to investigate characteristics in trans/supercritical jet processes, which is also applied in high Reynolds heat transfer boundary flow measurements of CO2 flow. The transient density field and boundary structure of the phase-transition interface were quantitatively measured, which gives the characteristic of CO2 jets fragmentation and atomization under the presence of interfacial tension and strong density pulsations. This talk will also discuss the use of new transient information obtained from the "critical boundary" for complex transport parameters from "liquid-like" and/or "gas-like" phases.

Keywords: Energy Resources/Equipment; Supercritical CO2; Hydrogen Energy; Visualization

KS02
Composite Materials in the Aerospace Industry: Some Opportunities and Challenges

Federica Daghia, Dr

École Normale Supérieure Paris-Saclay, France

Abstract: Due to their excellent specific properties, composite materials have been increasingly employed in the transport industry, and especially in the aerospace sector. This keynote presentation reviews some of the opportunities and challenges associated to the use of polymer matrix composites, particularly from the point of view of the mechanics of materials and structures. From the choice of the elementary constituents to some recent developments on manufacturing processes, from the modelling of the initial state of the structure after manufacturing to the challenges in predicting the failure of such highly heterogeneous and anisotropic materials, the presentation will cover different scientific and technological issues, and it will include some illustrations from the research work carried out at the Laboratoire de Mécanique Paris-Saclay, part of Université Paris-Saclay (France), together with its industrial partners.

Keywords: Polymer matrix composites; Damage modeling; Crack propagation; Experimental characterization; Numerical simulations.

KS03
Modeling and Simulation of Heavy-Lift Tethered Multicopter Considering Mechanical Properties of Electric Power Cable

Dong-Kyu Lee, Professor

Department of Aeronautics and Mechanical Design Engineering, Korea National University of Transportation, South Korea

Abstract: In case of a fire at a high-rise building which is densely populated, an extension ladder is used to rescue people who have yet to evacuate to a safe place away from the fire, whereas those who are stranded at a height that is unreachable with the ladder should be promptly saved with different rescue methods. In this case, an application of the tethered flight system capable of receiving power over a power cable from the ground to a multicopter may guarantee effective execution of the rescue plan at the scene where fire is raging without any restrictions of the flight time. This article identified restrictions that should be considered in the design of a multicopter capable of tethered flight aimed to rescue stranded people at an inaccessible location with an extension ladder at a fire-ravaged high-rise building and assessed its feasibility. A power cable capable of providing dozens of kilowatts of electricity should be installed to enable the implementation of the rescue mission using the tethered multicopter. A flexible multi-body dynamics modeling and simulation with viscoelastic characteristics and heavy weight of power cable were carried out to evaluate the effects of such cable of the tethered flight system on the dynamic characteristics of the multicopter. The results indicate that as for a heavy-lift tethered multicopter designed to be utilized for rescue operations, the properties of the power cable, such as weight, rigidity, and length, have a major impact on the position and attitude control performance.

Keywords: Multicopter; heavy lift; tethered flight; flexible multi-body dynamics; adaptive control.

KS04
Prediction of Process-Induced Distortion of Braided CFRP Composites Based on Effective Material Property and Cure Modeling

Sang-Woo Kim, Professor

Korea Aerospace University, Korea

Abstract: This study presents a method for predicting process-induced distortion (PID) in 2-D triaxially braided composite (TBC) structures using a simplified constitutive model for cure modeling and an analytical model for effective material properties (EMPs). The method considers the viscoelastic characteristics of polymer resin and various geometric parameters of the 2-D TBC, enabling quick and accurate prediction of the PID. The PID trend with curing time for an L-shaped TBC flange was analysed using finite element-based curing simulation and the effects of geometric parameters on the EMPs and PID of the 2-D TBC were also investigated. The findings of this study could improve the quality of composite structures during the design phase by providing a means of predicting the PID of the 2-D TBC structures.

Keywords: Composite material; Textile composite; Curing process; Process-induced distortion; Finite element analysis.

KS05
Active Noise Control Technology for Advanced Air Mobility Applications

Joong-Kwan Kim, Professor

Dept. of Unmanned Aircraft Systems, Hanseo University, Korea

Abstract: Active noise control technology has emerged as a promising solution to mitigate noise pollution inside advanced air mobility vehicles. In this presentation, we review the current state of active noise control technology for road vehicles and its potential application in advanced air mobility. We present a conceptual framework for designing active noise control systems, including sensor and actuator placement, control algorithm selection, and system integration. Furthermore, we discuss the challenges and opportunities associated with the deployment of active noise control technology for advanced air mobility, such as the limited space and weight requirements of airborne systems, and the need to balance noise reduction with other design factors, such as safety and performance. We also tested the concept of active noise control using a propeller trainer aircraft (Cessna 172s). With this test, we were able to confirm that it is possible to reduce the noise produced by the aircraft using active noise control. The experiment involved testing the aircraft under various flight conditions and measuring the noise produced by the propellers. The results of the experiment were then analyzed, and simulations were conducted to determine the effectiveness of active noise control in reducing the cabin interior noise. The confirmation of the feasibility of active noise control for propeller aircraft is an important step in the development of quieter, more sustainable advanced air mobility systems. This talk also highlights the potential benefits and identifies future research directions to further advance this technology in the context of next-gen transportation.

Keywords: Active Noise Control; Advanced Air Mobility; Ride Comfort; Noise and Vibration.

KS06
Hungarian Drone Coalition: Introduction to The Hungarian Drone Ecosystem and Development Strategy

Daniel ROHACS, Professor

Head of Department of Aeronautics and Naval Architecture, Faculty of Transportation and Vehicle Engineering, Budapest University of Technology and Economics, Hungary

Abstract: The presentation will shortly introduce the Hungarian drone ecosystem, provide the actuality, the core objectives and the expected results of the Hungarian Drone Coalition. It will cover the Hungarian Drone Strategy, the core expectations, strategic pillars, action items to reach the defined vision, and the results achieved so far. Finally, synergies with other related national initiatives will be discussed, such as the ZalaZone proving ground, and the DroneMotive test center.

Keywords: Drone coalition; drone strategy; UTM.

KS07
Nanocolloids: From Basic Experiment to Applications

Alina Adriana Minea, Professor

Gheorghe Asachi Technical University of Iasi, Romania

Abstract: Ultrahigh-performance cooling is one of the most vital needs of many industrial technologies. However, inherently low thermal conductivity is a primary limitation in developing energy-efficient heat transfer fluids that are required for ultrahigh-performance cooling.

Nanocolloids seem to be the future for most of the cooling applications. Nevertheless, several barriers need to be uptake to implement these new fluids in real life applications.

This lecture will discuss the variety of nanocolloids, together with their advantages and drawbacks. Plus, a special emphasis will be given to ionic liquids based nanofluids. Ionanofluids have multiple applications in many areas and especially in the solar area. More exactly, ionic liquids are already considered as a potential new heat transfer fluid in many applications and the increasing interest is due to their excellent tunable properties. Results of various research on ionanofluids obtained from different groups are to be presented and discussed, outlining the benefits and drawbacks.

Keywords: New heat transfer fluids; convection; ionic liquids; nanoparticles; numerical analysis.

IS01
Aerodynamic Performances of an Axial Transonic Compressor using Passive Control Systems

Cong-Truong Dinh

Hanoi University of Science and Technology, Hanoi 11615, Vietnam

Abstract: There are several reasons that cause axial compressors to reduce its performance and become unstable, including tip leakage flow and tip leakage vortex on the rotor tip clearance region, flow separation and reattachment phenomenon on the blade surfaces, the appearance of low-speed and low-pressure zones, etc. In reality, the active and passive flow control systems are the recommended techniques to extend the stall line and the stability of compressors. The research concentrates on the solutions using the rotor circumferential feedback channel and the rotor bleeding airflow technique to improve the aerodynamic performance, counting pressure ratio (PR), adiabatic efficiency (EFF), stall margin (SM), and stable range extension (SRE), of a single-stage axial transonic compressor, NASA Stage 37. Using 3D-RANS with the k-ε turbulence model, the numerical compressor is validated with experimental data before applying these passive methods. Four geometric constraints of the feedback configuration and four geometric combined a mass-flow rate dimensionless of bleeding port are used to carry out study parameters. The simulation results show that the SM upsurges 52% but EFF decreases 0.5% in the case of the rotor recirculation feedback channel, meanwhile, all aerodynamic features are enhanced by the values of 21% and 32.21% for SM and SRE, correspondingly. Applying other turbulence model, Fluid-Structure Interaction (FSI), also studying on optimization techniques, aeroacoustic characteristic, and new design of recirculation-bleeding channels are the recommendations for the future proposals.

Keywords: Single-stage axial transonic compressor; passive control systems; rotor circumferential feedback channel; rotor bleeding airflow port; 3D-RANS.

IS02
The Freezing Process of Water Drops – A Numerical Investigation

Vu Van Truong

Phenikaa University,

Abstract: Water drops freezing on aircraft under icing conditions decrease the lift force and increase the drag force, and thus affect aircraft controllability. Thereby, aircraft icing could induce a serious hazard for flight. Accordingly, understanding of the freezing process of a water drop becomes extremely important to not only in aircraft technology but also in other applications. Thus, we here present a direct numerical simulation of a water drop freezing while attaching to a cold surface. The sessile drop corresponds to positive Bond numbers Bo (i.e., Bo > 0), and the pendant drop represents the other values of Bo. The pendant drop breaks up into daughter drops when gravity dominates the surface tension force induced at Bo < 0. That is, a decrease in Bo enhances the breakup of the freezing drop. The breakup also depends significantly on the initial shape of the drop in terms of the contact angle at the plate □0, that is, increasing □0 induces breakup. In addition, the drop rapidly completes freezing due to breakup. In the case of non-breakup, the increase in Bo reduces the frozen drop height and decreases the time to complete solidification. The freezing process also consumes minimal time with small □0. The frozen drop has a cone near the axis of symmetry due to volume expansion of water upon solidification. This shape of the ice drop is in accordance with the experimental observation.

Keywords: Direct numerical simulation; Freezing; Water drop; Gravity; Aircraft icing.

IS03
Monitoring of Bridges and other Critical Objects using UAVs

Kinzhikeyev Sergey

Astana IT University, Astana, Kazakhstan

Abstract: Bridges are the most complex and expensive elements of roads, requiring a reasonably detailed design and technological development in the design, good organization, and high-quality performance in construction and restoration. Automated monitoring of bridges' conditions and timely maintenance is necessary to ensure bridge structures' safety. This study describes the creation of a system for automated monitoring and assessment of the vulnerability of bridges in the face of natural disasters and adverse climatic effects using data mining. In the Republic of Kazakhstan, transport plays an important role, so in the event of a 9-point earthquake in Almaty, where 350 thousand people may die, the primary mode of transportation for the evacuation of the population, according to the decision of the Government of the Republic of Kazakhstan, will be the railway transport. At the same time, critical objects for the sustainable operation of the railway will be bridges (the railway of the Republic of Kazakhstan has more than 1000 bridges, the earliest of which is 85 years old), and their technical condition still needs to be studied. Unmanned aerial survey systems are actively used to solve problems in infrastructure projects. UAV/UAS is an innovative technology that offers new ways to collect and process data while reducing project time and safety risks.

Keywords: Bridges, technical condition, monitoring, UAV, GIS

IS04
Aircraft Maintenance Practices using Virtual Reality

Nguyen The Hoang

Singapore Institute of Technology, 10 Dover Drive, Singapore
Vietnam Aviation Academy, 104 Nguyen Van Troi, Ho Chi Minh City, Vietnam

Abstract: Aircraft maintenance is considered the foundation for aircraft operations in assuring airworthy conditions. Traditional training set-up has several deficiencies pertaining to the availability of aircraft and specialized equipment. Therefore, studying to develop a solution, which has affordable cost and easily-accessible potential, to improve aircraft maintenance practical training is important for both academia and aviation industry. The present work has the purpose of developing a numericalbased application using Virtual Reality (VR) technology for sophisticated aircraft maintenance practices, applying to specific Airbus aircraft's Nose Landing Gear systems (A320). The VR platform is designed and developed using a loop of several phases. First, the related aircraft maintenance procedures from the aircraft manufacturer manuals are analyzed. Second, configurations and dimensions of the involved aircraft systems and components are modelled using Computer-Aided Design (CAD) software. Third, virtual maintenance working environment is developed using a free simulation platform (Unity). The results show highly promising potential in applying emerging technologies such as VR in the development of fully-digital solutions for aviation training, especially in a high-tech field such as Aircraft maintenance where complex mechanical systems and trictlyregulated procedures are involved. For future works, other aircraft systems as well as additional aircraft types could also be included.

Keywords: Virtual Reality; Aircraft Maintenance; Airbus AMM.

IS05
Development of Unmanned Aerial Vehicle industry in Asia

Preetwant Singh

Pegasus AC Aviation, Singapore

Abstract: This paper provides an overview of the current state of unmanned aerial vehicle (UAV) in terms of technologies and markets in Asian countries. It discusses the significant contributions of UAVs in various industries, including agriculture, environmental monitoring, infrastructure inspection, military and security. The paper also analyzes the factors driving the growth of the UAV industry in Asia, such as advancements in technology, increasing demand for UAVs in commercial applications, government support, and growing interest in swarming technology. The UAV market in Asia Pacific is projected to grow at a compound annual growth rate (CAGR) of 18.9% from 2020 to 2027. The work also highlights key challenges facing the UAV industry in Asia, such as regulatory frameworks, safety concerns, technology limitations, skilled personnel, and limited infrastructure.

Keywords: Unmanned aerial vehicle (UAV); Asian markets; UAV technologies; UAV operations and businesses.

IS06
A Noble Pedagogy Approach to Educate and Train Avionics Engineers for the New Economy in Vietnam

Lee Kar Heng

TBSS Center for Electrical and Electrical Engineering, Director, Singapore, Vietnam

Abstract: "A few mega-trends are shaping the future of Vietnam. The country's population is rapidly aging and global trade is declining. Environmental degradation, climate change, and the rise of automation are growing.", the World Bank reported on 23 April 2023. As Vietnam continues to grow in terms of automation, the manufacturing sector will attract more investments into the economy. The CIA.gov, in 2021, reported that the Manufacturing (under the Industry sector) made up around 33% of Vietnam's GDP. Advanced technologies under the framework of Industry 4.0 has improved the competitive of Vietnam's manufacturing sector, the up and coming challenge is to attract investment to increase the Research and Development GDP. The Royal Society, an U.K. based scientific academy, reported that Vietnam's Research and Development expenditure in terms of percentage of GDP in 2010 for Asia as China 3.1%, Singapore 2.9%, South Korea 5% and Vietnam 0.4%. There is a need to increase the expenditure on Research and Development, and more critically, education and training of competence Research and Development STEM practitioners to attract investments for establishment of regional Research, Design and Development centers into Vietnam. The Deputy Prime Minister Mr Vu Duc Dan has signed and issued a strategy for science, technology and information development until 2030, which will see an increase of investment into Research and Development to 2%. In addition, the strategy also aims to develop research institutes, universities and other science and technology organizations into major research subjects (Vietnam+, 2022).

This paper discusses an integrated methodology to elevate the current engineering graduates' research, design and development competence level. The discussion will commence with the current issues in Vietnam's engineering education in aviation and avionics, and then identify the gap(s) to achieving and producing competence STEM specialists' competence to attract Research and Development investments in the sector, as well as suggesting methods using education technology and solutions to close the gap(s).

Keywords: Education; Engineering; Research; Development; Aerospace; Aviation.

RS01
Energy Attenuation in Intelligent Aircraft Structures

Selim Gürgen

Department of Aeronautical Engineering, ESOGU, Eskişehir, Türkiye

Abstract: In the present work, energy attenuation properties of sandwich structures are investigated. In addition to the conventional sandwich structures, an intelligent concept was included by integrating the structures with a non-Newtonian material. The non-Newtonian material shows shear thickening effect under loading. Due to its thickening behavior, it contributes to the energy suppression upon loading. For this reason, the non-Newtonian material was filled into the holes drilled in the core material of the sandwich composites. The core material was extruded polystyrene (XPS) foam and the face sheets were made from aluminum alloys. From the results, energy attenuation of the sandwich structures shows enhanced properties by incorporating the non-Newtonian material into the composites.

Keywords: Non-Newtonian material; Energy attenuation; Impact.

RS02
Modal Analysis of a Body-Spring System Modelling an Insect Flapping-Wing Structure

Vu Dan Thanh Le[1], Anh Tuan Nguyen[1], Ngoc Thanh Dang[2]

[1] *Le Quy Don Technical University, Faculty of Aerospace Engineering, Hanoi, Vietnam.*
[2] *Le Quy Don Technical University, Post-Graduate Department, Hanoi, Vietnam.*

Abstract: Insect-mimicking flapping-wing micro air vehicles (FWMAVs) have attracted substantial interest in recent years due to a variety of potential civilian and military applications. Insect wings may be strongly deformed during flight, and their structures are generally anisotropic because of the combination of membranes and tapered veins. Hence, modelling the insect wing is an important and complex task. In this paper, we propose a body-spring system of an insect wing structure. For validation, modal analysis is performed, and the natural modes and frequencies are compared with those from an experiment and a finite element model. The results of the first two modes of the structure show good agreement. The proposed model can be coupled with aerodynamic codes to study the dynamics of FWMAVs.

Keywords: Flapping wing; modal analysis; body-spring system.

RS03
Application of Laser Distance Meters for Non-Contact Determination of Aircraft Weight and Centre of Gravity

Afig Hasanov, Islam Isgandarov, Elgun Aghayev

National Aviation Academy, Faculty of Physics and Technology, Azerbaijan

Abstract: The article presents the features of a new method that allows for the non-contact determination of the weight and centre of gravity of an aircraft. One of the variants of the mathematical model for implementing the proposed new method is considered, the essence of which is to measure the vertical displacements of the front and rear sides of the aircraft from reference points to the ground relative to the centre of gravity of the fuselage of the aircraft standing on the airfield. Mathematical expressions are given for determining the weight on the front and rear parts of the aircraft fuselage, obtained by solving differential equations for the dependence of the vertical displacement of the aircraft fuselage on its loading using the MATLAB program. It is shown that the error in measuring the vertical displacement determines the accuracy of calculating the degree of loading of the aircraft on its front and rear parts relative to the centre of gravity. To measure the vertical movement of the aircraft fuselage from the ground, a study is being carried out on the use of portable laser distance meters, which are installed on the ground under selected reference points in the front and rear of the aircraft fuselage. For experiments, portable laser distance meters of the VL53L0X type are selected, which have satisfactory parameters for measuring and non-contact determination of the weight and centre of gravity. The measurement scheme, software, and direct display of results on a computer are provided using the "Arduino" module.

Keywords: Aircraft; weight; centre of gravity; laser distance meters; non-contact.

RS04
The New Solution of Air Plasma Spray for Hardfacing

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Abstract: Thermal spray coating plays a significant role in industry. The wear-resistant deposition helps to provide a longer life cycle for the components. There is a small effort going into developing a coating that improves the coefficient of friction. Comparing with other deposition techniques, plasma spray coating can be recommended for a wide range of substrate materials to produce a stable, wear-resistant material. The plasma-sprayed deposition not only improves tribological performance but also embeds the desired mechanical and physical properties. In plasma spray technology, the inert gas used is mostly plasma jet. To create the wear-resistant coatings, the engineers apply self-flux or cermet powder, but these materials are expensive. Some positive results of deposition using the amorphous powder encouraged the engineers and researchers. But a few of the investigations on the air plasma spray using Fe-based powder used ordinary air as a potential substitution to save on production costs. The aim of this work is the study of Fe-based sparing involving the modification of a plasma torch, for which hardfacing provides the wear resistance.

Keywords: Wear resistance, Hardfacing; Air plasma spray; Self-flux powder; Amorphous Fe-based powder.

RS05
Mixing Process Effect in Shear Stiffening Gels for Aircraft

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Abstract: In the present work, we produced a kind of smart material, which is one of shear stiffening gels. To understand the effect of manufacturing process on the stiffening behavior, two different mixing procedures were used in the synthesizing process. In the first sample, manual mixing procedure was used while the second sample was produced by mixing the sample with a homogenizer. According to the results, mixing stage is significantly important on the stiffening properties of shear stiffening gels.

Keywords: Shear stiffening gel; Smart material; Mixing process.

RS06
Numerical Study on Bubble Growth and Collapse near a Solid Wall with a Gas Entrapping Hole

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Abstract: The highly nonlinear interaction between an oscillating bubble and the gas-liquid interface of bubble dynamics near a rigid wall with a gas-entrapping hole was numerically studied in this study. The evolution/interactions of the cavitation bubble and/with the gas-liquid interface were simulated based on a fully compressible mixture model of three-phase flow which was developed based on a dual-time preconditioning technique coupled with an interface-sharpening technique with a general curvilinear grid. The growth and collapse of a bubble in proximity to a rigid wall with a hole with different standoff distances were simulated and analyzed. The examined results showed that the gas entrapping inside the hole plays a vital role in the formation and direction of the liquid jet of bubble dynamics. Unlike the bubble collapse near a flat solid wall, the liquid jet was directed far away from the solid wall. The simulated results suggest a potential for improving the design and production of body surfaces, which are often corroded by the impact of the liquid jet caused by bubble collapse.

Keywords: Bubble dynamics, liquid jet control, bubble-gas interaction.

RS07
Investigated the Effect of Grid Patterns to the Grid Fins Aerodynamic Characteristics

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Abstract: In this study, three-dimensional simulations were performed using Ansys Fluent 19R1 to investigate the effect of grid patterns on fin aerodynamic characteristics. Three fin models were designed including square, tri, hexa grid patterns, alongside to be more independently comparative, other parameters consisting of frame dimensions, internal web thickness, chord length, reference area and grid cell area were kept similar between the models. The Mach number 0.7, 1.2, 2.5 corresponding to Subsonic, Transonic and Supersonic regimes were investigated for varying angles of attack from -5 to 15 degrees for each fin model. Three control coefficients, Ca, Cn and Chm were compared and they pointed out that the hexa fin pattern has many advantages over the other two fin patterns.

Keywords: Grid fin; Grid Fin patterns; Supersonic computation; RANs.

RS08
Longitudinal Motion Control of a Fully Submerged Hydrofoil Craft using Neural Network

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Abstract: In this paper, a longitudinal motion control system for a fully submerged hydrofoil is studied. A feed forward multilayered neural network is used for craft forward dynamics. The neural network is trained in a quasi-online regime in order to cope with changing dynamics of the craft. A feedback linearization controller for attitude control is designed. The performance of closed loop system is verified through simulation. The closed loop system stability is proved based on Lyapunov function theory. The simulation results show that the proposed control system is able to keep the craft in predefined height and serves the consideration in designing height control system for real crafts.

Keywords: Height control; longitudinal motion control; high speed craft; fully submerged hydrofoil craft.

RS09
A Model-Driven Approach to Develop Controllers for Quadrotor UAVs

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Abstract: This paper presents an object-unified control design, which is based on the Model-Driven Architecture (MDA) approach combined with the real-time Unified Modeling Language/Systems Modeling Language UML/SysML, in order to conveniently analyze, design and implement controllers of Quadrotor Unmanned Aerial Vehicles (Q-UAV). The paper shows out stepwise the adapted Q-UAV dynamics and control structure that are then combined with the specialization of MDA features as follows: the Computation Independent Model (CIM) is defined by the specification of use-case model to capture the requirements analysis of control; the Platform Independent Model (PIM) is then designed by specializing the real-time UML/SysML's features combined with the timing concurrency of evolution that depicts in detail structures and behaviors of controllers; the detailed PIM is subsequently converted into the Platform Specific Model (PSM) by using open-source platforms to quickly simulate and realize the Q-UAV controller. Based on this design model, a trajectory-tracking controller was deployed and tested that permits a Q-UAV to reach and follow the desired reference trajectory.

Keywords: Quadrotor Unmanned Aerial Vehicles (UAV), UAV control, model-based mechatronic system design, real-time UML/SysML, Model-Driven Architecture (MDA).

RS10
Using CFD Studies Effect of an Air Circulating Tank on Hydrodynamic Performance of a Hull

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Abstract: In this paper, effect of a bottom Air Circulating Tank (ACT) on hydrodynamic performance of a hull investigated by using a commercial Computational Fluid Dynamics (CFD). Firstly, hydrodynamic performance as the resistance acting on an original hull was computed by the CFD and compared with those of the experimental data to validate the CFD results. Secondly, a new hull with proposed bottom ACT had been computed and compared with the results of the original hull. From obtained results of the pressure distribution around hull and resistance acting on the hull were shown, the effects of the ACT on hydrodynamic performance of the hull were found. More ever, the target of this study is that understanding what happened in the ACT and how improving hydrodynamic performance of a hull with an ACT.

Keywords: Air circulating tank, Hydrodynamic performance, CFD, Hull, resistance.

RS11
Stress Investigation of FG-CNTRC Cylinder Shell in Thermal Environment

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Abstract: In this work, the stress investigation of the FG-CNTRC cylindrical shell in environment is presented. The governing equations are established by HSDT and temperature-dependent properties. An analytic solution using simple trigonometric series and the Laplace transform is employed to solve these equations. The present approach is verified by comparison with previous publications. The results show that this approach can determine the jump in the stress value at the boundary position.

Keywords: Thermoelastic analysis, FG-CNTRC, cylindrical shell, higher-order shear deformation theory.

RS12
NOTAR Helicopter Preliminary Design App

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Abstract: In the present paper, it is presented the NOTAR Design App, a tool for preconceptual design of a NOTAR helicopter simulating a hover flight. The theoretical backgrounds are briefly introduced and the used mathematical models are presented. It is noted that the main rotor balancing counter-torque is generated by two separate phenomena: the Jet Thruster Force and the Tail Boom Circulation Control. The Jet Thruster analysis includes sequential control volumes along the inside of the Tail Boom, while the Tail Boom Circulation Control comprehends the examination of a sectional area of the Tail Boom and corresponding integration along the slot length. Results of the app depend on the user inputs and show reasonable agreement with the expected values.

Keywords: Preliminary Design, Aerodynamics, Rotorcraft, NOTAR, Anti-Torque, Boundary Layer, Circulation, Vorticity, Potential flow theory.

RS13
Thermal Conduction Analysis of a Common Bulkhead Propellant Tank under Eccentricity Variations

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Abstract: In a common bulkhead propellant tank using cryogenic fluid, an increase in internal temperature can lead to oxidant vaporization, which negatively affects projectile performance and generates residual fuel. Thus, insulation between propellant and oxidant through common barriers is an important factor in the design of projectile propellant tanks. This study investigates the thermal conduction characteristics of the common bulkhead under eccentricity variations. In future design considerations, the structural safety of the oxidant and fuel tanks will be estimated through a buckling analysis using the calculated temperature distribution as thermal loads.

Keywords: Eccentricity, Temperature Gradient, Heat Conduction, Buckling Analysis, Common Bulkhead Propellant Tank.

RS14
Open-Source Tool for Rotorcraft Design

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Abstract: Any aircraft design is an iterative process, and the conceptual and preliminary design stages of the design process are prone to be object of many changes and hot fixes that require organization and methodical approaches. The main objective of this paper is to expose the main features added to this developing software tool, that will allow to shorten the time-frame of these two activities by using a MATLAB application that promptly iterates over performance and trim calculations of several rotorcraft configurations, using statistical weight distribution methods for centre of gravity estimation, linearisation of the balancing trim equations, and Blade Element Momentum Theory for trim and performance calculations, respectfully.

Keywords: Weight distribution, centre of gravity, preliminary design, helicopter trim.

RS15
Effects of Loading Rate and Crack Length on Interlaminar Fracture Toughness for CYCOM 977-3/IM7

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Abstract: Composite materials have high strength and high stiffness, but are vulnerable to internal damage such as delamination and cracks. Micro-cracks in composite structures can lead to sudden destruction of the structure. Therefore, when designing composite structures, it is necessary to consider interlaminar fracture toughness. In this study, End-Notched Flexure (ENF) specimens were manufactured and tested to identify the tendency of mode II interlaminar fracture toughness (GIIC) of CYCOM 977-3/IM7 composites according to changes in loading rate and initial crack length. This study confirmed that mode II fracture toughness increases with the loading rate. No significant difference was found in specimens with altered initial crack length.

Keywords: Interlaminar Fracture Toughness, End-Notched Flexure (ENF) test, Loading Rate, Crack Length, Composite.

RS16
Flight Simulation – Part 1-Algorithm and Calculation Module

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Abstract: Flight simulation is essentially used in pilot schools and in aircraft design. It can also be used as a learning tool for aerospace engineering students. Flight simulations of general aircrafts can be integrated into courses such as flight mechanics, introduction to aerodynamics and aircraft design. Setting up and solving the system of equations of motion are at the heart of the flight simulation. The algorithm and calculation module of the flight simulation program is described in this paper. Aircraft, environment and control data are used as inputs of the simulation model. Aerodynamic, gravitational, engine and landing gear force and moment models of a Cessna 172 Skyhawk are established. Flight modes such as level flight, climb, descent, turn, take-off and landing are simulated. The terrain, the sky, the coordinates and orientation of the aircraft in the Earth-fixed frame are simulated in a graphical simulation. The aircraft's orientation is also transferred into the Stewart platform simulation.

Keywords: Flight simulation, algorithm, equations of motion, aerospace, flight mechanics.

RS17
Flight Simulation – Part 2-Kinametics of a Flight Simulator System

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Abstract: In this study, a six-legged Stewart-Gough platform's 3D Solidworks model was imported into the Matlab/Simscape Multibody environment to create a kinematic model of the platform. Combined with an inverse-kinematic solving algorithm, the desired motion of the platform can be virtually achieved. This work is an essentially important step in developing a flight simulator system for pilot training purposes.

Keywords: Flight Simulation, Stewart-Gough platform, inverse kinematics, Matlab/Simscape Multibody.

RS18
CFD Simulation for Thermal Results on Honda Wave Alpha 110cc Motorcycle Exhaust Wall

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Abstract: The increasing number of private vehicles, especially motorcycles, in Southeast Asia raises concerns about emissions such as CO, NOx, SOx, and HC. Over time, these emissions can contribute to serious health issues, including cancer, respiratory, and cardiovascular diseases. Consequently, there is growing interest in designing motorcycle exhaust systems, with temperature being a primary concern alongside environmental pollution, emissions, and noise levels. In this article, we'll create a simulation model for the Honda Wave Alpha 110 cc motorcycle's exhaust pipe using ANSYS Fluent software. We'll analyze the exhaust surface temperature behavior at speeds ranging from 10km/h to 30km/h, confirming its accuracy through a verification experiment. Additionally, we'll explore enhanced exhaust pipe designs for improved human comfort.

Keywords: Honda Wave Alpha 110 cc, ANSYS Fluent, Motorcycle's exhaust pipe.

RS19
A UAF-Driven Point of View to Implement UAV Controllers

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Abstract: This paper proposed a Unified Architecture Framework (UAF) model for small-scale autonomous Unmanned Aerial Vehicles (UAVs) controllers, which is based on the Unified Modeling Language/Systems Modeling Language (UML/SysML), in order to systematically analyze, design and implement control parts of UAVs. The paper brings out step-by-step the UAF-based development lifecycle of an UAV controller, including the overview dynamics and general control structure of UAVs to capture the requirement and control analysis models, as well as the specialization of UML/SysML's features to design structures and behaviors in detail for the UAV controller. The detailed control design model is then converted into the object-oriented implementation model in order to quickly simulate and realize the controller. Based on this approach, a trajectory-tracking controller of a miniature quadrotor UAV was retro-designed and simulated.

Keywords: Unmanned Aerial Vehicles (UAV), UAV control, UML/SysML, Unified Architecture Framework (UAF).

RS20
Research and Development Airboats for Rescue Works

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Abstract: This paper mentions to a research and development of an airboat. The airboat is developed for rescues works from storms, floods in rainy season with bad weather conditions. A special feature in the design of the airboat is using a hybrid propulsion system, water propeller and air fan. With the advantage of using two propellers, the airboat can run on multi-terrain such as on water surface, reed areas, swamps, on muddy surfaces. With a special feature in the hybrid propulsion system, when the air boat runs on water surface, it uses the water propeller for creating propulsion. The water propeller is designed to be flexible. When in use, the water propeller is dropped into the water, when not in use, the water propeller is pulled up on the airboat with its moveable shaft. There is a hydraulic coupling between the propeller shaft and the main engine of the airboat for easily switch the operating mode between the water propeller and the air fan. In addition, the hydraulic coupling also makes it easy to release and retract the propeller into the water. When running on surfaces other than water, the airboat uses the air fan propulsion mode. The propulsive fan is a specialized fan with high rotation speed and large air flow volume. The propulsive fan is directly driven by an aeronautical engine.

Keywords: Airboat, Hybrid, Propeller, Fan, Multi, Terrain.

RS21
A Study on Propeller for Airboats

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Abstract: This paper mentions to a research and development on a propeller for an airboat. The propeller is designed for an airboat with 5.18 meter in length, 1.98 meter in breadth and 0.17 meter in draft. The airboat is developed for rescues works from storms, floods in rainy season with bad weather conditions and operation on multi-terrain. A special feature in the design of the airboat is using a hybrid propulsion system, water propeller and air fan. With the advantage of using two propellers, the airboat can run on multi-terrains such as on water surface, reed areas, swamps, on muddy surfaces. This study will present a design of a propeller for the airboat when it runs on water surface. The propeller is designed based on ship theory and CFD test. A propeller with four blades was made for the airboat.

Keywords: Airboat, Hybrid, Propulsion, Propeller, CFD.

RS22
Concurrent Design of Composite Pressure Vessels

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Abstract: The paper presents a new approach to development integrated mathematical model for composite pressure vessels (CPVs) based on concurrent engineering (CE). Important parameters of CPVs in both design and production phases were considered simultaneously within a unified information space. On that basis, mathematical model of CPV was built with 9 design variables, 14 functional constraints and 3 performance criteria. Then, the genetic algorithm (GA) was applied for that model and a set of 75 Pareto optimal solutions was found. Based on these solutions, an appropriate design was chosen for the next manufacturing phase.

Keywords: Concurrent engineering, composite pressure vessels, integrated mathematical model, genetic algorithm.

RS23
Design and Manufacturing a Virtual Reality Parachute Training Simulation System

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Abstract: This paper proposes a virtual reality parachute training simulation system that provides trainees with a realistic experience of the entire process, from boarding the plane to the moment when their parachute touches the ground. By incorporating virtual reality glasses with synchronized physical effects, the trainees can fully immerse themselves in a simulated environment that replicates the feeling of being on a plane, the view from the plane, and the experience of parachuting as if it were reality. The simulator plays a crucial role in the training of parachutists as it provides them with a safe environment to gain confidence and experience before attempting actual parachute jumps.

Keywords: Parachuting, Simulator, Skydiving, Virtual Reality, Visualization, Psychological Courage.

RS24
An Experimental Investigation of the Effect of Biodiesel on the Emission Characteristics of Diesel Engines

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Abstract: This research focuses on investigating an alternative fuel approach for diesel engines, specifically examining the impact of biodiesel when blended with diesel. Specifically, the study addresses relevant aspects of emission characteristics in single-cylinder diesel engines in terms of external characteristics. To conduct the experiments, three different fuels were tested: commercial diesel, a biodiesel blend with 10%, and 20% derived from palm oil (referred to as B0, B10, and B20, respectively). The results indicated that the addition of biodiesel in the diesel blend led to a reduction in CO pollution levels compared to the original diesel fuel. However, it was observed that the NOx pollution levels increased with the addition of biodiesel. Nevertheless, as the concentration of biodiesel increased from 10% to 20%, the NOx concentration tended to decrease. Overall, the incorporation of biodiesel resulted in decreased CO emissions. In conclusion, the integration of biodiesel and diesel oil presents a promising alternative for promoting the reliable and sustainable operation of diesel engines.

Keywords: Biodiesel, experimental, engines.

RS25
Experimental Data Analysis: Effects of the Convective Mach Number on Mixing Layer Turbulence

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Abstract: The turbulent mixing layer is one of the three popular free-shear turbulent flow models in nature and engineering. There are many methods for studying mixing layers, but the experimental methods are high effectiveness by their accuracy and clear pictures of the flow behavior. Experimental studies have the common feature of obtaining large data sets on the flow velocity field, and the analysis and processing of experimental data is an important step in experimental research. In this study, we analyze experimental data from published data by (Kim et al. 2019). The effect of convective Mach number on the length of the transition region and the development of shear-layer thickness are analyzed. The isotropic of the velocity fluctuation in the mixing region is also analyzed for understanding detailed aerodynamic features.

Keywords: Mixing layer turbulence, Convective Mach number, Data processing.

RS26
Flight Simulator to Investigate the Impact of Different Types of Actuators on the Piloting

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Abstract: With the advancement of techniques for designing manned and unmanned aircraft, testing systems and dynamics in a previous phase became necessary. These tests are done through simulations with movement on or without a Stewart platform. The tests aim to determine the in-flight behavior of the systems and dynamics of the designed aircraft. Aiming at this type of test, this research aims to design a flight simulator with a flight envelope safe enough for actuator testing. The data used for the aircraft dynamics are from the F-16 Block 50. The tested actuator models are from the A7-D, DC-8, and F-16 aircraft. For the development of the flight envelope, a Stability Augmentation System (SAS) was designed using root locus, seeking optimization in various sets of speed and altitude. This scaled gain technique makes the aircraft controllable by one pilot throughout the defined flight envelope. Ultimately, a stable and reliable simulation environment was obtained for testing different actuators. The next step in this research is embedding the software on the robotic simulation platform SIVOR for pilot tests.

Keywords: Flight simulation, SIVOR, Aircraft dynamics, A7-D, DC-8, F-16.

RS27
CFD Analysis of Aircraft Wheel Washing Machine

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Abstract: This study presents a computational fluid dynamics (CFD) analysis of an aircraft wheel washer machine. Design and performance analyses were optimized. The aim of this study is to investigate the fluid dynamics and flow properties in the wheel washer and to identify potential improvement areas. Various design parameters such as nozzle size, nozzle placement and spray angle were evaluated to optimize the efficiency of cleaning the aircraft rim and minimize water consumption. The results obtained from the CFD simulations offer quantitative data on the effectiveness of the wheel washer machine in removing contaminants from the aircraft wheels. Also, the analysis helps in identifying regions of recirculation and stagnation, leading to potential design modifications to improve fluid flow and cleaning performance.

Keywords: CFD analysis, aircraft maintenance, aircraft wheel washer machine, fluid dynamics, cleaning efficiency.

RS28
Attitude at Altitude: Ethics and Flight Safety

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Abstract: This article explores the critical relationship between organizational ethics and the prevention and mitigation of aviation accidents. While factors such as knowledge of regulations, procedures, education, and experience are recognized as significant contributors, the study emphasizes the pivotal role of organizational ethics in this context. Specifically, the research focuses on examining the interconnection between organizational ethics and safety culture within the aviation industry, as well as the influence of organizational ethics on the occurrence and prevention of accidents. The investigation involves an analysis of aviation accidents where organizational culture has played a determining role. Furthermore, the study aims to develop a digital platform that highlights the ways in which individual and organizational ethics contribute to risks in flight safety. By comprehending the impact of organizational ethics on safety culture, this research seeks to provide insights into enhancing safety practices and fostering a culture of ethical responsibility within aviation organizations.

Keywords: Organizational ethics, Aviation accidents, Safety culture, Flight Safety, Digital platform

RS29
Computational Model for the Aerodynamic Characteristics of Sounding Rockets

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Abstract: This study presents a computational aerodynamic model for sounding rockets based on the combination of the panel method and theoretical and semi-empirical formulae. The advantages of this model include low cost and the capability of working on a wide range of the Mach number. The reliability of the model was verified by comparing the computational results with data from supersonic wind tunnel experiments. Using the present computational model, the authors have studied the aerodynamic characteristics of a sounding rocket in the range of Mach number from 0 to 4. The study also proposes a method to calculate the aerodynamic coefficients in the unsteady case.

Keywords: Aerodynamic characteristics, sounding rocket, panel method, flight dynamics and stability, unsteady.

RS30
Radar Design Techniques Deployed in Anti-Drone and Counter UAV

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Abstract: Drones and UAVs flying in the proximity of an airport or airfield is a current concern. Drone and UAV operators or pilots should not fly near the airports or airfields because the flying aircraft have difficulty in seeing them. In addition, some drones and UAVs fly into these critical areas for hostile objective including create safety hazards to the airport and airfield environments. This paper discusses the modern radar design techniques used in anti-drone solutions and counter unmanned aerial vehicles system (CUAS) to detect and tracking them so that counter measures can be executed to prevent damages, in terms of lives lost or financial suffers. The paper development will commence with problems and technology progression in terms of drones and UAV advancement, the design features desired are then discussed and last but not least, a design case will be evaluated to conclude the present anti-drone and UAV radar design.

Keywords: Drone, UAV, Radar, Anti-Drone, CUAS, Airport.

RS31
Combustion Characteristics of Jet Fuel Surrogates

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Abstract: In this study, a rapid compression machine (RCM) was used to study the traditional JP-5 fuel and the JP-5 surrogate. In the experiment, the ignition delay characteristics with low-to-intermediate temperature compression temperatures ranging from 675-800K, compression pressures of 10, 15 and 20bar, and equivalence ratios of 0.25 and 0.37 are discussed. Among them, the auto-ignition delay time of JP-5 and the surrogate all shorten the ignition delay time as the compression pressure and equivalence ratio increases, where the negative temperature coefficient (NTC) phenomenon begins to occur at temperatures of approximately 732-746K. It is worth noting that an increase in pressure or the equivalence ratio of the two fuels changes their low-temperature oxidation reaction pathway, thereby increasing the initial temperature of the NTC. The two fuels showed similar ignition characteristics in the measured temperature range. The difference between the two fuels was approximately 6.18% when the equivalence ratio was 0.37, which means that the surrogate reproduced the ignition delay characteristics of the real fuel.

Keywords: Rapid Compression Machine; Jet Fuel; Auto-ignition; Aircraft Engine; Chemical Kinetics; Negative Temperature Coefficient.

RS32
Fire Detection in Surveillance Camera Systems using a Deep-Learning-Based Approach

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Abstract: With the popularity of Closed Circuit Televison (CCTV) camera systems, the need for fire detection systems using CCTV cameras has increased continuously. Conventional thermal and smoke sensors work well to detect nearby and indoor fires but cannot warn about remote situations. This paper proposes a camera-based fire detection method using a combination of a preliminary detector and a Convolutional Neural Network (CNN) classifier. The preliminary detector detects bounding boxes using primary image features such as color, brightness, and motion features. Based on these bounding boxes, we build and train a CNN to eliminate false positives and get an accurate fire detection result. The proposed method is evaluated on seven fire videos under various conditions, reaching an average accuracy of 96.58% and over 90% in experimental setups.

Keywords: Fire detection, Surveillance System, Morphology, Deep Learning, Convolutional Neural.

RS33
Design the Flight Trajectory of a Cruise Missile to Avoid Threats

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Abstract: This paper presents a method for designing the trajectory of a cruise missile, taking into account the avoidance of threats. The authors conducted a study on the researched guidance laws that optimize the consideration of kinematic errors. The novelty of the research lies in constructing a trajectory for the missile that considers the avoidance of threats using selected control signals, namely normal acceleration in the horizontal planes. To validate the research results, simulations were performed using MATLAB Simulink. The obtained results demonstrate the feasibility of the proposed trajectory, as the missile successfully follows the terrain, avoids threats, and successfully eliminates predetermined targets. The application of the research findings extends to trajectory design for aerial vehicles in general, with a particular focus on cruise missiles.

Keywords: Cruise missile; Threat; Avoiding threats; Terrain following; Normal acceleration.

RS34
Aerodynamic Effect of Different Drone Blade Tip Shapes

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Abstract: With the increase in the use of drones in various industries, their mass use quickly spread and with it the need to increase their range and flight time. Although the improvement of these drones falls on various aspects of the UAV as a whole, their performance can be improved directly on its propulsion hardware, that is its rotors. Therefore, this work falls on the study of the aerodynamic effect of different drone blade tip shapes on the overall performance of the rotor. Firstly, 3-D models are made with different types of modifications, from linear and elliptical taper to different twist ratios. Once a mesh, volume, and time-step study are done using a high fidelity CFD program (STAR CCM +), these rotors are simulated at 4000 RPM which, corresponding to their diameter, approximates to a Reynolds number of 47,000. Once the best rotors are chosen, they are 3-D printed and tested on a test stand to verify any trends discovered in the CFD study. In the end, any level of taper proved beneficial, with improvement between 3 and 5% for most cases.

Keywords: Drones, Blade Tip Modifications, Numerical Analysis, Experimental Analysis, Low Reynolds Number.

RS35
Energy and Comfort in Virtual Aircraft Passenger Cabin Section – Part I: Design of the Cabin and Hydrothermal Manikins

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Abstract: In this work, results of two software's are presented. A first software, that simulates the three-dimensional geometry of an aircraft passenger cabin section, generate the occupants and interior and surroundings surfaces, and a second software, that simulates the passenger's thermal response, evaluates the level of thermal comfort that the passengers are subjected. The aircraft passenger cabin section consists of five rows, upper ventilation system and luggage compartment, floor and roof and is occupied by thirty passengers. Each row is made up of six benches: three on the left and three on the right side. In this work, the design of the aircraft passenger cabin section and hydrothermal manikins are presented and the level of comfort, which passengers are subject, is calculated. According to the results obtained, in general, taking into account the input data, the level of thermal comfort is acceptable according to category b of the international standards.

Keywords: Aircraft passenger cabin, hydrothermal manikins, thermal comfort.

RS36
Energy and Comfort in Virtual Aircraft Passenger Cabin Section – Part II: Three-Dimensional Airflow Around Hydrothermal Manikins

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Abstract: In this work the software that simulates the turbulent three-dimensional airflow around the passengers and inside the aircraft passenger cabin section, CFD, and the software that simulates the thermal response of the aircraft passenger cabin are presented. The first software calculates the field of air velocity, air temperature, among other environmental variables, around the passengers and inside the aircraft passenger cabin, while the second software calculates the temperature field on the surrounding and interior surfaces and the air flow to which the interior space is subjected. In this work, the field of air velocities, air temperature, among other environmental variables, are evaluated, either around the occupants or inside the aircraft passenger cabin. Air velocity distribution around the occupants are presented. According to the results obtained, it is possible to verify that the air velocity is higher in the upper passenger body section, namely in the head.

Keywords: Aircraft passenger cabin, hydrothermal manikins, airflow around the occupants and inside the space.

RS37
Energy and Comfort in Virtual Aircraft Passenger Cabin Section – Part III: Binaural Mannequins

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Abstract: In this work a software which simulates the interior acoustic of the aircraft passenger cabin, applied in the study of the reverberation time inside the aircraft passenger cabin, is used. This software considers all details of the aircraft passenger cabin, namely, seats, floor, side panels, roof, upper luggage compartment and binaural mannequins. These virtual mannequins, equipped with two ears and a mouth, allow for a new approach to acoustics in interior spaces. In this work, the geometry of the aircraft passenger cabin and the binaural manikin's are prepared. In this preparation, the space was simplified by numerically reducing the number of surfaces, according to x, y and z direction, maintaining all geometry of the aircraft passenger cabin and the occupants. The reverberation time, in space with complex geometry, was calculated using two virtual manikin´s sitting side by side in the centre of the aircraft passenger cabin.

Keywords: Aircraft passenger cabin, binaural manikins, acoustic level, reverberation time.

RS38
A Comparative Study of the Force of Shot for 5.56mm Assault Rifles with Different Barrel Lengths

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Abstract: The paper aims to apply the dynamic gun theory to establish a mathematical model to determine the force of the shot for two models of 5.56mm assault rifles with different barrel lengths (460 mm – model A and 380 mm – model B) when firing 5.56x45mm NATO ammo. The research results indicate that the force shot mainly depends on the pressure in the barrel, and when the bullet exits the muzzle barrel, the force of the shot is different for two model rifles. The force of the shot for model A is greater than that of model B when the bullet leaves the muzzle barrel. The mathematical model in this paper is a reference for analyzing forces acting on the mount and the stability mode of this gun.

Keywords: Assault Rifle, Force of the shot, Space-mean pressure, Barrel chamber, Barrel muzzle.

RS39
Development of Markov Chains for Random Vertical Wind Profiles

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Abstract: In this paper, we create a Markov chain model to generate random wind profiles up to an altitude of 40 km based on actual wind data over Luc Ngan dist., Bac Giang, Vietnam. The wind speed and direction are assumed statistically uncorrelated; therefore, two independent Markov chains are built for these quantities. For the wind speed, the probability of transition between discrete states is approximated by the Weibull distribution whereas the von Mises probability density function is applied to the transition of the wind direction. The relationships between the coefficients of the probability density functions and the altitude at each state of the wind speed and direction are obtained. The statistical properties of the simulated wind profiles are compared with those of the actual data to validate the present Markov-chain model.

Keywords: Weibull distribution function, wind speed, Markov-chain model, von Mises distribution, wind profiles.

RS40
Process Structure Proposal for the Automation of Aircraft Maintenance Planning

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Abstract: Planning and scheduling for aircraft Maintenance, Repair, and Overhaul (MRO) companies are always critical for assuring the availability and accuracy of the aircraft's release back into service, which guarantees the maximum utilization of the operators' planes and minimum time on the ground. The construction of a well-structured logic for tasks' priority performance and precedency is a main factor for achieving the objective of effective planning and scheduling. This paper will focus on the importance of creating such a structure and highlighting the benefits it provides to the overall maintenance process. Maintenance staff, supervisors, technicians, and external service providers may coordinate their efforts and resources based on a shared knowledge of work priorities. This unified strategy boosts productivity, reduces uncertainties, and minimizes wasted time of manually distributing those tasks.

Keywords: Task precedence, Tasks priority structure, MRO, Aircraft maintenance, Automation of planning.

RS41
Power Generation Sustainability in Aviation Ground-Based Maintenance, Rectification, Overhaul, Testing Operations

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Abstract: The Maintenance, Repair and Overhaul operations play an important role in all mission critical systems, obviously these include Airports and Aircraft used in civilian and military. MRO activities include. But but not limited to, overhaul, inspection, replacement, defect rectification, and the embodiment of modifications, compliance with airworthiness directives and repair. This is to ensure the continuing airworthiness of an aircraft or aircraft part. For commercial airlines, the MRO facilities are usually located at the airline's major hub since MROs are owned and operated by the airline and they provide all levels of services and repair. The air traffic control operations ensure aviation safety and interruption are not tolerated. While the power provided by the utility companies are largely dependable, blackouts and interruptions can happen, one of the most uncontrollable contribute is bad weather where airports may be powered by emergency power supply during outrages. But what if the cut over fails? The electrical switch-gear connects the backup power generation or the uninterruptible power supply (UPS) system to mission critical systems, equipment or facilities. It is usually composed of electrical disconnect switches, fuses or circuit breakers used to control, protect and isolate electrical equipment. This type of equipment improves the reliability of the power supply. On 18 December 2017, the Atlanta Airport reported a power interruption due to failure in the switch-gear. When the main supply failed, the switch-gear failed too causing the airport to suffer a total of power outrage. This resulted cancellation of 1100 flights and suffered 30000 passengers (Ben 2017). What if the failure in switch-gear can be detected beforehand?

Keywords: Power, Sustainability, Aviation, Critical Mission, Reliability.

RS42
Study the Influence of the Presence of Air in the Hydraulic Brake on its Operation

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Abstract: Throughout the utilization, maintenance, and operation of recoil mechanisms, particularly concerning recoil and counter-recoil brakes, the infiltration of air into the fluid is a persistent occurrence. This paper presents a mathematical model that was built based on theories of air flow, employing Bernoulli's equation and Euler's equation in combination with the dynamic theory of body motion. Within this mathematical model, a comprehensive analysis of the impact of air flow through the "orifice area S_z (x) " has been conducted, accompanied by the proposition of potential resolutions to enhance the recoil brake's performance.

Keywords: Recoil mechanism, Recoil brake, Air flow, Fluid flow, Bernoulli's equation, Euler's equation.

RS43
PID Controller System for Hexacopter using Angular Rate Correction Block

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Abstract: This paper proposes three-loop PID (Proportional Integral Derivative) controllers to improve the system performance of a hexacopter. Firstly, the dynamic equations for the modeling process of a hexacopter are presented. Then three diagrams of the controller system are created using the PID controllers. The first system has a position and attitude controller; the second one has one more block, body angular rate correction. The simulation is carried out to study and compare the performance of two controller systems.

Keywords: Hexacopter, PID controller, trajectory tracking.

RS44
Research and Design the Wing Structure Separation for HALE UAV

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Abstract: In recent years, only unmanned aerial vehicles (UAVs) with small wingspans have used the wing modularization method, and for long-winged aircraft, continuous wings dominate the others. Regarding long-wing aircraft, it is complicated for manufacturers to make the whole wing intact and take the aircraft to take-off locations. With current technology, producing such a long and continuous wing is difficult, so it is essential to separate the wing into modules and fabricate them. Before using UAVs, operators need to assemble the parts of the wing together and reinforce the connected region. This will facilitate the shipping, assembly, operation, and maintenance of the UAVs. Meanwhile, this paper also provides an idea for the improvement of removable wing structure design and the simulation of new wing structural strength and endurance. The stress concentration at the connection locations is quite large and requires further study of the structure in these areas. We have found two main approaches: the conventional method using bolts and the new method using the magnetic lock. Although connecting by magnetic lock brings convenient benefits for operating, this approach is less stable in the section of the structure than the conventional one. Based on this research, we can optimize the wing structure and junction methods for the purpose of manufacturing and commercializing this product in the future.

Keywords: HALE UAVs, Aeronautical Structure, FSI, Magnetic Lock, Bolts and nuts.

RS45
Navigating the Winds of Change: Case Studies of the Latest High-Level Research in the MRO Industry

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Abstract: The need for faster and more efficient transportation is a primary driver of the airline market and the aviation industry's growth. The Maintenance, Repair, and Overhaul (MRO) market which is a part of the aviation sector is critical to assuring aircraft safety, reliability, and efficiency and reserve a big place for its success rate. High-level research in this field is important for pushing development and innovations, enhancing MRO processes, and staying relevant in a competitive environment. This paper will investigate the most recent high-level research in the aircraft MRO industry. It examines the progress that this field has experienced and highlights some of the case studies applied by several MROs. The positive impact of each of these new applications is discussed, including increased operational efficiency, cost savings, and fuel saving. Furthermore, the article discusses various problems and limitations that MRO firms may experience while adopting research results.

Keywords: Innovations, Industry 4.0, Aviation MRO, Aircraft maintenance technologies.

RS46
An Automatic Control System for the Take-off and Landing of a Quadrotor

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Abstract: This paper exposes a synthetic method of take-off and landing automatic control system for a quadrotor. This study solves two problems, one is the transfer from manual control to automatic control, and the second one is from the automated control system upgrading to programmatic control. Then, we conduct a semi-natural simulation and survey the kinetic quality of this system.

Keywords: Quadrotor, take-off and landing, automatic control, unmanned aerial vehicles, control system.

RS47
Analysis of the Efficiency of the Distributed Detection Algorithm Based on the Application of Soft Decision Scheme in Local Sensors with a Non-Ideal Communication Channel

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Abstract: In this work, the influence of characteristics efficiency of communication channel on the system's performance of distributed detection algorithm based on using the soft decision scheme in the local sensors is analyzed. The dependencies of the total error probability of such algorithm on signal-to-noise ratio (SNR) channel with gaussian noise and fading is given. The gain in the detection efficiency by algorithm based on using the soft decision compared to the efficiency of hard algorithm is confirmed, even under fading communication channel. In addition, with such conditions, it was shown that system efficiency can be increased on account of increasing the number of sensors used.

Keywords: Wireless sensor networks (WSN), Distributed detection, Total probability error, Bit error probability, Soft decision, Fading.

RS48
Evaluation of the Heat-Resistant Properties of an EPDM-based Insulator in Solid Rocket Motors

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Abstract: Internal insulator is an important part of the solid rocket motor because it protects the motor case, preventing the case from reaching high temperatures that endanger the structure of the rocket motor. This work presented the evaluation results of the heat shielding properties of the insulator materials based on EPDM with a magnesium hydrosilicate filler. The insulator has high heat resistance, and low thermal conductivity, and protects the motor case well during the firing test.

Keywords: EPDM-based insulator, Heat shielding material, Solid rocket motor.

RS49
The Impact of AI on Sustainable Procurement: Revolutionizing Aviation Maintenance Operations

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Abstract: The aviation industry is constantly seeking ways to improve efficiency and sustainability, notably, in the face of ongoing pressures such as airspace constraints, labor, and skill shortages, supply chain disruptions, delayed aircraft deliveries, and strikes. This paper discusses the potential impact of artificial intelligence (AI) on aviation maintenance operations, specifically in the areas of predictive maintenance, inventory optimization, and supplier assessment and selection in the context of sustainable procurement. By analyzing existing literature, we argue that AI has the potential to revolutionize aviation maintenance operations and contribute to more sustainable procurement in the industry.

Keywords: Artificial Intelligence, Aircraft Maintenance, Aviation, Sustainability, Procurement.

RS50
An Optimization Technique for Horizontal Axis Wind Turbines' Airfoils Using XFOIL and Genetic Algorithm

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Abstract: In recent years, wind energy has become an increasingly popular form of renewable energy. For this reason, research on the optimization of wind turbines is also receiving great amounts of attention. This thesis aims to propose a comprehensive optimization technique for horizontal wind turbines' aerofoils. Genetic algorithm (GA) included in MATLAB Global Optimization Toolbox is chosen as the optimization algorithm. To evaluate the aerodynamic performance of the aerofoils, XFOIL is utilized. A detailed workflow is built using MATLAB programming language. To validate the results, two aerofoil optimization problems are solved using the proposed optimization technique. The validation results show that the technique has successfully optimized the baseline aerofoils. Compared to the references, the optimized aerofoils show similar geometry and aerodynamic performance. Further improvement can be made to the formulation of constraints and post-optimization evaluation, so that the process can be more streamlined.

Keywords: HAWTs, airfoil optimization, Genetic algorithm, XFOIL, MATLAB.

RS51
Numerical Optimization of Aerodynamic Noise Reduction in a Micro Turbojet Engine using Nozzle Chevrons

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Abstract: Noise pollution and emissions from jet engines are a pair of problems that seriously affect human health and the ecological environment. This paper presents an optimization process of aerodynamic noise reduction for a micro turbojet at the Propulsion Systems Laboratory, School of Mechanical Engineering, Hanoi University of Science and Technology. Using nozzle chevron designs and numerical simulation approach with Broadband Noise Source model, four major parameters, such as number of chevrons (NOC), nozzle chevron configuration, length and angle, are considered. The outcome results show the Surface Acoustic Power Level (SAPL) figures between prototype and parameter studies' models. The proposal having a NOC of 8, sharp edge with length of 57 mm and angle of 100o is the best formation, where SAPL at the output cross-section diminishes from nearly 110 dB to 103 dB.

Keywords: Micro turbojet, nozzle chevrons, aerodynamic noise, optimization.

RS52
Optimization of Acoustic Performance of Double-Layer Absorbers Based on Cellular Foams

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Abstract: In this paper, we propose a method to optimize the sound absorption coefficient (SAC) of double-layer foam (DLF) absorbers via the equivalent-fluid approach and particle swarm optimization (PSO) technique. The acoustic performance of these DLF absorbers is predicted by theoretical models within a set of input parameters that include geometrical and transport parameters of the inner layers (i.e., foam layer). Using PSO technique, the optimal geometrical parameters of DLF structures for enhancing the SAC target in frequencies of interest. The observed results for low and middle frequency bands are given to illustrate the contribution of the proposed method.

Keywords: Cellular foam, Sound absorption, Double-layer absorber, Optimization.

RS53
Study to Determine the Blast Wave Pressure of Simultaneous Explosions in the Aquatic Environment

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Abstract: This paper presents the research results of determining the pressure value of the shock wave at any point in the water environment according to the distance to the center of the explosion using ANSYS AUTODYN software. The calculation results in the paper are compared and verified with the data determined from the theoretical method. Carry out calculations, evaluate the influence of single or simultaneous explosions on the shock wave pressure value at the survey point, and draw some comments.

Keywords: Shock wake pressure, Underwater, Mesh Lagrange, Mesh Eurle, Underwater vehicle.

RS54
A Computational Investigation on Underexpanded Supersonic Free Jet with Imposed Pressure Perturbation

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Abstract: A computational investigation of flow structures of underexpanded supersonic free jet under periodic pressure perturbation condition has been carried out in the present study. Reynolds-averaged Navier-Stokes (RANS) equations with a single-equation Spalart-Allmaras (SA) turbulence model have been used in the computation. Static pressure at the nozzle inlet has been modelled with steady as well as time-dependent varying frequency sinusoidal profiles. Keeping the ambient conditions fixed, the NPR of the nozzle has been changed in the range between 2.2 to 3.2. In both steady and fluctuating cases, it is found that the shock cell structure and flow properties are significantly affected by variation of pressure. Lengths of shock cell and supersonic core are found to increase with the increase of inlet pressure. For fluctuating inlet pressure, the flow field is found to respond in a different manner depending on whether the NPR is increasing or decreasing. The frequency of oscillation of inlet pressure is also found to play significant roles. Hysteresis behaviour in several flow parameters has been identified. The maximum hysteresis of 28.7% occurs at the highest applied frequency of 100 Hz for first shock cell length. The generated thrust at different conditions does not show a hysteretic behaviour (below 1%) in oscillating NPR conditions except at high frequency where the maximum hysteresis is found to be 4.7%.

Keywords: Keyword one, Underexpanded jet, Converging nozzle, Supersonic flow, Hysteresis.

RS55
Exploring the Efficacy of VR/Haptic Technologies in Elevating Aviation Training and Simulation

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Abstract: Virtual Reality (VR) and Haptic systems have revolutionized aviation training, providing immersive experiences for operators. This research assesses their effectiveness and limitations using the Analytical Hierarchy Process (AHP) methodology. Through AHP, this study optimizes training engagement, primary task performance, and cost-effectiveness. Findings have significant implications for enhancing the skills of aviation professionals. The objective is to provide a rigorous assessment of the current state-of-the-art in VR/Haptic systems, exploring their potential in the aviation industry. This research contributes to advancing training methodologies, aligning with the industry's continuous pursuit of innovative approaches.

Keywords: Analytic Hierarchy Process, Sustainable Virtual Reality, Haptic Technology, Aviation Training, Simulation, Human Factors.

RS56
Effect of Geometric Parameters of Cross-flow Wind Turbine on the Generator Power for Moving Road Vehicles

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Abstract: Wind energy is a clean resource that is being efficiently harnessed from anchored onshore and offshore wind turbine farms or for home and office purposes. Meanwhile, transport vehicles are facing energy problems when fossil fuels pollute the environment and electric batteries do not have large storage capacity, so electric vehicles are required to be charged continuously. Therefore, the article proposes a potential solution of using a Cross-Flow Wind Turbine (CFWT) system with a special structure installed on moving automobiles to provide local energy for batteries or onboard electrical devices. Taking advantage of the compressed air near the boundary layer on a moving vehicle, especially at the rooftop position, and the combination of structures such as the deflector and the wing airfoil help wind turbines generate more power. In the framework of this paper, the investigation of two parametric studies of the impeller blade, including blade angle α and blade thickness T, displays that the obtained CFWT power is over three times higher than the open-flow wind turbine, which is calculated theoretically according to the Betz's law.

Keywords: Cross-flow Wind Turbine, Moving Vehicle, Boundary Layer, Compressed Airflow, Patent.

RS57
Aerodynamic and Aeroacoustic Characteristics of Toroidal Propeller using CFD Approach

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Abstract: One of the downsides that keeps drones from being widely used is the noise they make. This study presents an optimization process of aerodynamic noise reduction for a new propeller designs at the Propulsion Systems Laboratory, School of Mechanical Engineering, Hanoi University of Science and Technology. Using new propeller designs and numerical simulation approach with Broadband Noise Source model, four toroidal propeller designs parameter such as number of blades (NOB), spanwise configuration, the width of the blade in the radial direction, tip geometry are considered. The outcome results show the Sound Pressure Level (SPL) figures and Thrust between four geometry studies' models. The propeller having a NOB of 3 in general gives the most optimal efficiency in terms of both thrust and SPL, where SPL at the output cross-section diminishes from nearly 139 dB to 1121 dB and Thrust increase from nearly 6.2 N to 8.7 N.

Keywords: Toroidal Propeller, number of blades, Thrust, Sound pressure level, CFD.

RS58
Performance of a Micro Wind Turbine Retrofitted with a Prototype Flow Acceleration System at a Typical Urban Site of Dhaka, Bangladesh

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Abstract: A flow acceleration system (FAS) comprised of a compact diffuser with flange at the exit was designed, fabricated and retrofitted with a commercially available micro wind turbine. After design and laboratory experiments, pilot testing at the rooftop of a building in a typical urban site at Dhaka, Bangladesh was conducted to compare the power generation performance with a bare turbine of same specifications. The obtained data indicate the augmentation in power and de-escalation in cut-in speed, suggesting that the FAS augmented wind turbine can be an effective solution for power generation in the context of urban areas in Bangladesh.

Keywords: Wind Turbine, Renewable Energy, Flow Acceleration system, Power augmentation.

RS59
Research of Kinematics and Solutions to Overcome the Delay Caused by the Steering Control Unit in the Automatic System of Controlling the Angle Stability of the Aircraft

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Abstract: This paper presents the research results on the factors affecting the control kinematics of the automatic system of controlling the angle stability of the aircraft. In which, the influence of the delay time caused by the steering control unit (SCU) is focused on research. Then, the paper presents studies on solutions to overcome the effects of delay time to improve the kinematic quality of the automatic control system on aircraft. The results of the dynamic simulation of the system by the automatic control system modeling and analysis software will demonstrate the studied solutions.

Keywords: Automatic control, aircraft control, angle stability, delay time, steering control unit.

RS60
Methods of Trajectory Correction Employing the Pulse Steering Array and Global Navigation Satellite (GNSS)

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Abstract: This paper presents methods to correct trajectory of artillery rockets employing the pulsejet control systems and global navigation satellite system (GNSS). In this control algorithm, the minimum time between two consecutive pulsejets depends on physical characteristics of the rocket and trajectory parameters instead of a given constant value. The simulation results and comparison between the cases indicate that the method of trajectory correction proposed in this paper has advantages over the other methods when it requires the least number of pulsejets and the value of each pulsejet to ensure the collision point error is within a given threshold.

Keywords: Artillery missile, Pulse steering array; Trajectory tracking, Impact point prediction.

RS61
The Importance of Periodic Measurement of Vibration Values to Prevent CNC Spindle Tool Runout in the Aviation Industry

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Abstract: In machining operations in the aviation industry, it is very important to produce the final product in the correct dimensions with the desired surface roughness and economy. Many studies have proven that tool runout occurring in CNC spindles negatively affects production efficiency. Periodic vibration measurements of the spindle can prevent unexpected downtime, control tool runout, and, when necessary, control the optimization of cutting parameters and tool paths. In this study, the effects of tool runout in manufacturing, the importance of periodic vibration measurements for the spindle, how to perform periodic maintenance in this area, and what it will affect are emphasized.

Keywords: Aviation, CNC Spindle, Vibration Measurement, Periodic Maintenance, Runout.

RS62
Revolutionizing Aviation MRO Training: Exploring the Impact of Digitalization

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Abstract: Aviation Maintenance, Repair, and Operations (MRO) training is transforming with advanced digital integration. This research examines digitalization's impact on MRO training across job roles. Employing a systematic method, the study evaluates training effectiveness, efficiency, user satisfaction, and technical feasibility. By analysing the most important and critical dimensions, an in-depth investigation into digitalization's dynamics emerges. Findings underscore tailored training's necessity aligned with job requirements. Seamless digital integration into existing systems and resource optimization emerge as imperatives for sustained MRO digitalization. The study lays the groundwork for informed strategies, enhancing MRO efficacy and integration within the evolving aviation landscape.

Keywords: Analytic Hierarchy Process, Sustainable Virtual Reality, Haptic Technology, Aviation Training, Simulation, Human Factors.

RS63
An Analytical Method for Solving the Problem of Stationary Motion of a Shell Segment under the Influence of a Harmonic Cylindrical Wave in an Acoustic Medium

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Abstract: An approach to the solution of noise absorption problems of Kirchhoff-Love shell segments based on the method of compensating loads is presented, which makes it possible to obtain analytical solutions of such problems for any kind of boundary conditions corresponding to real methods of anchoring. The motion of a shell segment in an acoustic medium under the influence of a harmonic cylindrical wave whose focus coincides with the center of the shell is studied. The motion of the segment is defined as a superposition of displacements of the whole cylinder in the acoustic medium and compensating loads, which are convolutions of forces with influence functions for displacements. The magnitudes of these forces are determined from the boundary conditions. The proposed solution is universal, which allows it to be applied to any type of real fixation of shell segments.

Keywords: Kirchhoff-Love shell, acoustic medium, noise absorption, influence functions, Fourier series, harmonic oscillations.

RS64
A Technique to Speed-Up Solving Linear Algebraic Equations in the Finite Element Method

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Abstract: Computational speed plays a critical role in the application of the Finite Element Method (FEM), especially when the number of elements is relatively large. The calculation speed of FEM depends on two factors including the speed of calculating the overall system of linear algebraic equations and the convergence speed. This report presents the neighbor node technique to speed up calculating the overall system of linear algebra equations, thereby reducing computational time in FEM. This technique increases the speed of traditional solving methods such as Gauss, Gauss Jordan, Gauss-Seidel, and Successive Overrelaxation (SOR). When the number of elements is large enough, the time of computing the system of linear algebraic equations using the neighbor node technique reduces significantly compared to without applying the technique. For example, the Gauss method with the neighbour node technique solves the system of overall linear algebraic equations approximately 2 times faster than without applying the technique.

Keywords: The Finite Element Method, linear algebra equations.

RS65
Composite Materials for Space Radiation Shielding: A Review

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Abstract: Developments in space technologies, which emerged as an outcome of the space race during the Cold War, have gained further momentum in the last decade with the adaptation of new technologies such as artificial intelligence, robotics, hybrid propulsion systems, advanced materials and advanced manufacturing methods to the industry. With these developments, the number of deep space missions has increased and spacecrafts performing these missions has been directly exposed to high levels of radiation in the space environment where there is no magnetosphere. These high radiation levels caused by GCR (Galactic Cosmic Ray) and SPE (Solar Particle Events) in the space environment can cause the electronic equipment in spacecraft to lose functionality. Space radiation also poses a significant obstacle for future manned missions to Mars. With this regard, the aim of this study is to investigate composite shielding materials to reduce the effect of space radiation on spacecrafts.

Keywords: Space radiation, Composite materials, Radiation shielding, Gamma, Attenuation.

RS66
Study on Rotor Interactional Effects on Aerodynamic Noise Characteristics of Quadrotor Unmanned Aerial Vehicle

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Abstract: The rotor-rotor interactional effects cause complex and highly unsteady flow fields around neighboring rotors, which are directly related to the aerodynamic performance and noise generation of the multirotor UAV. The rotor-rotor interaction is significantly affected by the separation distance between adjacent rotor tips. In this paper, the effects of adjacent rotor tip distance on the aerodynamic noise characteristics of quadrotor systems are investigated. In this paper, the effects of adjacent rotor tip distance on the aerodynamic noise characteristics of quadrotor systems were investigated by using a tool for calculating the aerodynamic noise characteristics of rotating system have built based on combining the unsteady panel method and acoustic analogy on the basis of solving the FW-H equation base on Najafi's formulation 1C.

Keywords: Aerodynamic noise, unmanned aerial vehicles, unsteady panel method.

RS67
Exploring the Sustainability Effects of High-Altitude UAV Components using Multicriteria Decision Analysis

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Abstract: This study employed the Analytic Hierarchy Process (AHP) method to assess sustainability criteria for High-Altitude Solar-Powered Unmanned Aerial Vehicles (UAVs). The findings revealed the overarching importance of environmental sustainability, highlighting the significance of energy efficiency and materials selection. Economic sustainability was identified as a vital dimension, emphasizing cost-effectiveness, revenue generation, and contributions to local economies. Furthermore, social sustainability dimensions underscored the importance of community engagement, ethical data practices, and skills development. The analysis of sub-criteria further elucidated the nuanced aspects of sustainability assessments, providing valuable guidance for stakeholders and decision-makers in the optimization of UAV technology while aligning it with sustainability objectives.

Keywords: Sustainability Analysis, High-Altitude UAV, Multicriteria Decision Making

RS68
Application of Drones for Road Condition Assessment

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Abstract: Drones have become everyday applications for humanity, being integrated into various industries. Their cost-efficient remote sensing capabilities make drones an irreplaceable option for industries like agriculture, aerial imagery, and security. One emerging application area for drones is smart cities, where they are used to gather real-time data for other systems within the city. Aerial inspections are another important use case for drones, including railroad inspection, road inspections, and traffic monitoring. However, further clarification is needed regarding viable drone configurations and operational models. In this paper, we developed a UAS-based road surface monitoring system scheme. We selected a readily available UAS for the task and evaluated different operational models through a model study. We assessed the effectiveness of single and dual placement on UAS stations for a 480 km rural road. Additionally, we evaluated different logistical models, such as hub-spoke and point-to-point, to develop an efficient road condition assessment scenario.

Keywords: UAS, Road surface monitoring, GIS, quality assessment, object detection

RS69
Improving Automated Monitoring the Technical Conditions of Bridges using UAVs

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Abstract: According to the US National Earthquake Information Center (NEIC), during the XX century, about 2000 earthquakes of magnitude seven or more occurred in the world, about 1 million people died in them, and at the beginning of the XXI century, two powerful earthquakes killed over 50,500 people. Numerous destructions and human casualties during earthquakes in Türkiye on 02/06/2023 are notorious. Earthquakes rank third among all natural disasters in terms of fatalities (17% of the total fatalities). According to experts, in the event of a devastating earthquake in Almaty, irretrievable losses will amount to about 300 thousand people, up to 60 percent of buildings will be destroyed, and direct damage will amount to about 200 billion tenge. Transport systems are a significant part of society's social and economic activities and must respond to devastating earthquakes promptly. This article discusses the problem of ensuring traffic safety in railway transport by creating a system for automated monitoring of the technical conditions of bridges and transport infrastructure in conditions of natural disasters and adverse climatic impacts based on advanced technologies.

Keywords: GIS, UAV, various sensors, bridges, natural disasters, railway.