International Symposium On Electric Aircraft & Autonomous Systems

ISEAS

16-18th December 2021

Eskisehir Technical University, Eskişehir, TÜRKİYE

Abstract Book

Editors

T. Hikmet Karakoç - Öznur Usanmaz - Ravi Rajamani - Hakan Oktal
Ali H. Ercan - Alper Dalkıran

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International Symposium on Electric Aviation and Autonomous Systems 2021

ISEAS'21Abstract Book

International Sustainable Aviation and Energy Research Society

EDITORS

T. Hikmet KARAKOÇ

Öznur USANMAZ

Ravi RAJAMANI

Hakan OKTAL

Ali Haydar ERCAN

Alper DALKIRAN

CO-EDITOR

Hurşit DEĞİRMENCİ

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International Symposium on Electric Aviation and Autonomous Systems (ISEAS – 2021)

Edited by Prof. Dr. T. Hikmet Karakoc, Prof. Dr. Öznur Usanmaz, Prof. Dr. Ravi Rajamani, Prof. Dr. Hakan Oktal, Asst. Prof. Dr. Ali Haydar Ercan, Asst. Prof. Dr. Alper Dalkıran.

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Prof.Dr. T. Hikmet Karakoç

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Symposium Chair

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Symposium Chair

Prof.Dr. Hakan Oktal

Symposium Chair

Message from the Symposium and Course Chairs

It is our great pleasure to invite you to the International Symposium on Electric Aviation and Autonomous Systems (ISEAS) which will be held on Online Platform ZOOM on December 16 – 18, 2021.

Aviation is considered as one of the major sources of environmental problems and considered a prominent cause of sustainability. Future trends in aviation could constitute a major impediment to having sustainable development in economic, social, and environmental perspectives. Sustainable aviation is a long-term strategy aiming to offer innovative solutions to the challenges facing the aviation industry.

As we are in an era in which there is a continuous progress in aviation, we would like to invite researchers, scientists, engineers, practitioners, policymakers, and students to this international Symposium and Course to exchange information, present new technologies and developments, and discuss the future direction, strategies, and priorities in the field of sustainability.

ISEAS aims to handle a broad range of electrification of aerial vehicles all-electric aircraft, electric generation, and storage in aerial vehicles, and so on.

ISEAS 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 December 2021.

Best wishes,

T. Hikmet Karakoç, Öznur Usanmaz, Ravi Rajamani and Hakan Oktal

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Ruxandra Mihaela Botez, L'École de Technologie Supérieure (ÉTS), Université du Québec, Montreal, Québec, Canada

Peter Dannenmann, Computer Science, Department of Engineering, Rhein Main University of Applied Sciences, Germany

Raj Das, Aerospace and Aviation Department, RMIT University, Australia

Cengiz Hacızade, Istanbul Technical University, Faculty of Aeronautics and Astronautics, Istanbul, Turkey

Birol Kılkış, OSTIM Technical University, Aerospace Engineering Department, Turkey

Narayanan M. Komerath, Taksha Institute, USA

Ian McAndrew, Capitol Technology University, USA

John Olsen, School of Mechanical and Manufacturing Engineering, The University of New South Wales, Sydney, Australia

Paul Parker, Faculty of Environment at the University of Waterloo, Canada.

Max Platzer, University of California Davis, USA

Ravi Rajamani, Cranfield University, UK - Editor in Chief, SAE Aerospace Journal, USA

Invited Speakers

Kongpan Areerak, Institute of Engineering, Suranaree University of Technology, Thailand

Nguyen Dinh Dung, Department of Aircraft System Design, Faculty of Aerospace Engineering, Le Quy Don Technixcal University, Hanoi, Vietnam

Oliviu Şugar-Gabor, School of Science, Engineering and Environment, University of Salford, England

Berkant Göksel, IB Göksel Electro fluid systems, Germany

Teodor Lucian Grigorie, Military Technical Academy "Ferdinand I" in Bucharest, Romania

Pavol Kurdel, Faculty of Aeronautics, Technical University of Kosice, Slovakia

Alejandro Murrieta-Mendoza, Amsterdam University of Applied Science, Netherlands

Vis Sripawadkul, Aerospace Engineering, Faculty of Engineering, Kasetsart University, Thailand

Peng Wei, Mechanical & Aerospace Engineering, George Washington University, USA

Artur Zaporozhets, Institute of Engineering Thermo physics of NAS of Ukraine

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KS01
Where Does the Electricity Comes From

Birol Kilkis

OSTIM Technical University, Turkey

Abstract: This presentation focuses on the origin of the electricity, processes involved, and storage. It is argued that even 100% renewable energy resources are used like PV or PVT plants, exergy destructions play an important role in avoidable CO2 emissions, which render a zero-carbon aircraft impossible. Regarding energy storage, electric or hydrogen aircraft options are also compared.

KS02
Fault Detection, Isolation and Accommodation for the UAV Flight Control system

Chingiz Hajiyev, Prof.Dr.

Istanbul Technical University, Faculty of Aeronautics and Astronautics

Abstract: Faults in dynamical systems can be detected using the innovation sequence of Kalman filter. If the system operates normally the normalized innovation of Kalman filter is a Gaussian white noise with a zero mean and a unit covariance matrix. Faults in the system affect the characteristics of the normalized innovation by changing its white noise nature, shifting its zero mean, and varying unit covariance matrix. Therefore, in this case, the fault detection problem is reduced to the problem of the fastest detection of the deviation of these characteristics from nominal. This study proposes a new fault detection, isolation and accommodation methods that are sensitive to changes in mean and covariance of the innovation of Kalman filter. In the presented methods, the multiple noise scale factors (MNSFs) are used as statistics for monitoring system faults. Proposed innovation-based fault detection, isolation and accommodation algorithms with MNSF are used in the flight control system of unmanned aerial vehicles (UAVs).

KS03
Sustainability in Aeronautical Design

Ian McAndrew PhD FRAeS, Professor

Capitol Technology University, USA

Abstract: We have mathematical theory and applications that enables an assessment of a design for inherent weakness and failure risks, yet there are life cycles of and guarantees of frequently less than 5 years. This presentation draws on several research programs and argues what we are failing to achieve or ignore in a design for achieving stainability. It further argues that how we can address the economic issues that longer life cycles can create.

KS04
The Road to the Electrification of Aircraft Powertrains

Dr John Olsen

The School of Mechanical and Manufacturing Engineering, The University of New South Wales, Sydney, Australia

Abstract: Owing to concerns that we are consuming far too much of the world's finite supplies of crude oil, I have had a desire to electrify the powertrain of aircraft for many years. However, at present, the gravimetric specific energy of lithium-ion batteries is seventy times less than aviation gas. This large difference has forced me to consider the hybridization of aircraft powertrains, especially for light aircraft. This is the same path that was taken by the automotive industry. In this talk, I wish to discuss the advantages and disadvantages of electrification of aircraft powertrains. In doing so, I will talk about energy storage in batteries and flywheels, Paschen's law, electric motor/generators, electrodynamic thrust, fuel cells, he advantages and the implementation of superconductivity. Later, I will talk about hybridization of aircraft powertrains. In particular, I will discuss the advantages and disadvantages of the three main topologies (parallel, series and power/split), especially on fuel consumption. I will also discuss the effect of aircraft weight on fuel consumption because I believe that this is the key to the acceptance of hybridization. Finally, I will discuss thermal management and the harvesting of energy that would otherwise be lost.

KS05
On Large-Scale Production and Storage of Renewable Energy to Enable the Transition to Sustainable Aviation

Professor Max F. Platzer

University of California Davis, USA

Abstract: The increasingly urgent need to transition to an emission-free global economy no later than 2050 raises the question whether there are sufficient renewable energy resources on our globe to achieve the reduction of greenhouse gas emissions necessary to prevent irreversible climate change. Although aviation currently contributes less than three percent of the total global emissions the switch to battery or hydrogen-based propulsion is becoming increasingly important or, at the very least, fuels will have to be used that cause no net increase in CO2 emissions. In either case, the energy required for electric propulsion or for the production of hydrogen or synthetic fuels directly competes with the renewable energy demands for the other parts of the global economy. Hence large-scale production and storage of renewable energy will be the key toward a successful decarbonisation of the global economy.

KS06
Solar-Electric Long Endurance Reflector Craft for Meteorology and Climate Simulation

Dr. Narayanan M. Komerath

Taksha Institute, USA

Abstract: A prime requirement to combat Climate Change is temporally and spatially-resolved data on atmospheric conditions and solar input planetwide. Scientists increasingly agree that direct intervention is needed to buy time. The Glitter Belt architecture of high-altitude, long endurance reflective vehicles serves both as meteorology platforms and if needed, as a scalable, reversible option to reduce insolation. This talk focuses on the electric-aircraft aspects of Flying Leaflet (FLT) and Flying Leaf (FL) vehicles that comprise the initial Glitter Belt system. The 30.5km altitude and glide requirements down to the Stratosphere provide unique challenges and opportunities. Conceptual design, small scale design-build-fly tests, and dynamic flight simulation are used to remove uncertainties and derive properties of this system. The FLT, a 32m span, 4m chord flying wing, carries a variably-deployed Mylar sheet to 30.5km, and joins with 10 other similar craft to form an FL with 12 BLDC motors driving low-inertia propellers. Motor speed control provides additional degrees of freedom. The rise of solar power with altitude is a unique feature. Temperature varies from the 85 deg. C of parts exposed to the Sun, to below -57 C of the Stratosphere at night. Motor cooling in near-vacuum, rendezvous and swarm operation for high-precision distributed antenna applications pose unique challenges.

KS07
Electric Aircraft: Motivations and Barriers to Adoption

Paul Parker, Professor and Associate Director - Environment

Waterloo Institute for Sustainable Aeronautics, University of Waterloo, Waterloo, Canada

Abstract: Electric aircraft became a certified aviation option in 2020 when the European Aviation Safety Agency, EASA, certified an electric two-seat aeroplane. The new technology offers several potential benefits that motivate adoption, including reduced greenhouse gas emissions, reduced lead emissions, reduced noise and reduced operating costs. However, barriers such as technology uncertainty, limited battery capacity, limited battery life and battery replacement costs may limit the adoption of this new technology. The rate of adoption of this technology in the first target market, flight schools, will depend on the relative strength of these benefits and barriers among key stakeholders. This study provides insights from surveys of three cohorts: student pilots, instructors and managers/others. The top motivation differed across these groups as student pilots rated reduced emissions highest while instructors and flight school managers rated reduced costs for training as their strongest motivation. Reduced accident risks were rated as a stronger motivation by managers than the other groups. Battery endurance and the continued dominance of fossil fuel technology were rated as the strongest barriers to adopting e-plane technology. Recognizing different perceptions among key stakeholders is critical to enabling market entry and creating a path for electric aviation success.

KS08
Automated Checking of an Autonomous Aerospace System's Sensor Instrumentation for Failure Detection, Identification, and Recovery

Peter Dannenmann, Prof. Dr.rer. Nat

RheinMain University of Applied Sciences, Faculty of EngineeringAnBrückweg, 26, 65248 Rüsselsheim, Germany

Abstract: Besides the capability, to pursue a mission under normal circumstances autonomously, autonomous systems in addition have to deal by themselves with the issue of possible failures of their subsystems or components. Moreover, for aerospace systems normally during a mission there exists no "safe state" to which they can switch e.g. like a car by stopping and driving to the roadside. For that reason, for autonomous aerospace systems, Failure Detection, Identification, and Recovery (FDIR) is a vital technique to ensure the safe operation of such systems. FDIR techniques enable these systems to remain in an operational mode after some possible failure has occurred at least long enough to land safely or even better to continue the mission even in a degraded mode.While commercial aircraft use a high level of redundancy, modern autonomous unmanned aerial vehicles do not possess such a high number of redundant systems. Therefore, it is important, to identify the root cause of some failure immediately during operations and possibly reconfigure the system such that it can continue its mission. This presentation shows methods to check an autonomous aerospace system's sensor-instrumentation with respect to its capability to identify a foreseen set of possible failures unambiguously. This identification of the root cause of some failure is a necessary prerequisite for recovery measures that permit the continuation of the system's mission.

KS09
Light-weight Cellular Materials for Next Generation Electric Aircraft

Raj Das, Professor

RMIT University, Melbourne, Australia

Abstract: As cores of sandwich structures, the mechanical behaviour of polymeric closed-cell foams is critical for the integrity of structures. This research aims to develop and validate foam micro-models incorporating microstructural variability and investigate how the microstructural variability affects the macroscopic mechanical behaviour of closed-cell foams. It involves micro-mechanical modelling using the finite element method, imaging techniques and images analysis for realistic foam microstructure characterisation, and numerical and experimental testing for prediction and validation of foam mechanical properties. Results show that the stiffnesses and strengths of closed-cell foams decrease with increasing cell size and cell wall thickness variations. The strengths are more sensitive to the variations compared to the stiffnesses, and the compressive strength is more sensitive than the shear strength. The compressive stiffness and strength is dependent on cell shape, while the shear stiffness and strength is independent of cell shape. Cell wall buckling followed by material yielding is observed.

KS10
Recent Developments in Electric Propulsion

Ravi Rajamani

drR2 consulting / University of Connecticut, USA

Abstract: Since the certification of the Pipistrel Velis Electro airplane in 2019, there have been many developments in the field of electric propulsion. In this talk, we will discuss some of these new developments, and we will also discuss what the regulators are doing to react to this new industry.

KS11
Morphing Wing and Morphing Wing-Tip Design for Flow Transition Delay

Ruxandra Mihaela Botez, Full Professor and Canada Research Chair Tier 1 Holder in Aircraft Modeling and Simulation Technologies

École de technologie supérieure, Université du Québec, Canada

Abstract: One of research axes in the Green Aircraft Technologies concerns morphing aircraft optimized design with the aim to reduce fuel consumption. The morphing aircraft technology was applied with the aim to delay flow transition (from laminar to turbulent regime), thus, to reduce drag, and fuel consumption. Piezo-electric sensors of Kulite type were used to measure the pressures and to find the flow transition on both morphing wing and wing-tip, and to compare their values with their numerical values obtained using 2D and 3D aerodynamic methodologies; optimized airfoil shapes were obtained for flow cases expressed in terms of Reynolds, Mach numbers, and angles of attack. In order to obtain these shapes, two different types of morphing wings and actuation systems were employed: 1) classical wing-box equipped with smart material actuators, and 2) regional aircraft wing-tip equipped with in-house electrical actuators. The wing-tip was composed of a wing and an aileron. The morphing wing and the morphing wing-tip equipped with sensors, actuators and controller were designed, manufactured and tested in the IAR-NRC wind tunnel. The flow transition was delayed, that lead to drag, and fuel reductions. The morphing wing and morphing wing-tip design will be compared in terms of methodologies and results.

IS01
Fuel Burn and Aircraft Trajectory Optimization

Alejandro Murrieta-Mendoza, Ph.D.

Amsterdam University of Applied Science, Netherlands

Abstract: Aircraft engines require significant quantities of fuel to generate the power required to fly. Burning this fuel causes the release of polluting particles to the atmosphere such as CO2 and others. The optimization of aircraft flight trajectories has been identified as a way to reduce fuel requirements, thus reducing pollution. In this presentation, the application of different metaheuristic optimization algorithms to improve the cruise flight phase cost in terms of fuel burn is discussed. The algorithms implemented for the optimization strategies are genetic algorithms, the artificial bee colony, and the ant colony algorithm. The fuel burn aircraft model used here is in the form of a Performance Database. A methodology to create this model using a Level D aircraft research flight simulator is briefly explained. Weather plays an important role in-flight optimization, so a method for incorporating open source weather is discussed. The results obtained from the optimization algorithms showed that every optimization algorithm was able to reduce fuel consumption for each flight, thereby reducing polluting emissions.

IS02
Monitoring the technical state of heat pipelines with using UAVs

Artur Zaporozhets, Associate Professor

Institute of Engineering Thermophysics of NAS of Ukraine

Abstract: The possibilities of thermal aerial photography for detecting different types of defects on pipelines in a functioning state are explored. A method for monitoring the technical condition of pipelines using UAVs is presented. The characteristics and capabilities of the proposed set of devices for monitoring thermal losses in pipelines based on quadrocopters are considered. The created hardware-software complex for diagnosing the state of trunk pipelines of heat networks based on the UAV is considered. The obtained experimental results, confirming the possibility to confirm the differences in the technical condition of pipelines. The creation of mobile information-measuring systems based on UAVs makes it possible to monitor the state and dynamics of the characteristics in time and space of the studied objects, both in on-line modes and other modes. With normal operation of the studied pipelines, the current remote control is the most economical compared with other means of control. This allows to use such measuring tools to create the necessary databases for monitoring the characteristics of the thermal state of heat networks to predict their dynamics.

IS03
Stability Analysis of More Electric Aircraft Power Systems

Associate Professor Dr. Kongpan Areerak

Institute of Engineering, Suranaree University of Technology, Thailand

Abstract: The More Electric Aircraft (MEA) is an essential concept and tendency in modern aerospace engineering. Most loads of electrical power system on a MEA are regulated power converters. These loads behave as constant power loads that can significantly affect system stability. The system will become unstable and will be unstable to operate at the rated power. Therefore, the stability issue is very important. In this presentation, the concept of stability analysis is introduced with the example research works. The results indicate that the proposed stability analysis can predict the unstable point and can provide the dominant system parameters in term of stability margin. Moreover, the adaptive stabilization technique to provide the considered aircraft power system always stable is also presented. The intensive time-domain simulation and experiment were used to validate the results from the theory.

IS04
An Improving Method for Fault Detection in Aircraft

Nguyen Dinh Dung, PhD

Department of Aircraft System Design, Faculty of Aerospace Engineering, Le Quy Don Technical University, Hanoi, Vietnam

Abstract: Sensors play a significant role in aircraft. The quality of sensor operations determines the stability and safety of the aircraft operation. This study presents a novel methodology for identifying and fixing faults of angular velocity sensors on aircraft. Firstly, the fault detection and diagnosis algorithm is extended to cope with fault types of angular velocity sensors. Secondly, the identifying and fixing faults algorithms are found to be sensitive to the initial condition. The problem is analysed theoretically, and subsequently, a novel identifying, and fixing faults is proposed to detect, estimate, and fix the angular velocity sensor faults. Identifying and fixing faults contains three steps, including fault diagnosis, fault identification, and fault correction. The identifying and fixing faults is verified using numerical simulation experiments, which show good identifying and fixing faults performance.

IS05
Improving the Efficiency of Unmanned Aerial Systems Through Wing Morphing: A Case Study for the Hydra Technologies S4 Éhecatl UAS

Oliviu Şugar-Gabor BEng, MSc, PhD, MRAeS, FHEA

University of Salford, England

Abstract: Aviation is a significant contributor to carbon dioxide emissions and global warming. Switching to a more sustainable growth and operation model will require the introduction and adoption of new technologies. One promising technology is wing morphing, the dynamic change of wing shape during flight to maximize aerodynamic efficiency for all flight segments. This presentation addresses the optimization of the Hydra Technologies S4 Éhecatl Unmanned Aerial System using a morphing wing concept. A part of the wing's upper surface is morphed, as function of the flight condition, by placing actuator lines at several positions along its span. The optimal displacements are found by using a hybrid algorithm based on the meta-heuristic Artificial Bee Colony algorithm and a classical gradient-based search routine. To efficiently calculate the wing aerodynamic characteristics, novel nonlinear lifting line and nonlinear vortex lattice solvers are developed and coupled with a two-dimensional viscous flow solver. The effects of the fuselage and tail are included from a panel method analysis, while viscous drag is estimated using strip theory, empirical and experimental approximations. The optimizations and three-dimensional results are obtained for fifteen flight conditions, corresponding to cruise and surveillance flights at various altitudes. Comparisons between the original and morphed geometries show the conditions for which significant lift-to-drag ratio improvements are obtained using the upper surface morphing concept.

IS06
Synthesis of Knowledge in The Field of Management of Avionics Systems Used for Specific Air Transport Objects

Assoc. Prof. Eng. Pavol Kurdel, PhD.

Technical University of Kosice, Faculty of Aeronautics, Slovakia

Abstract: The invited lecture is focused on the supervision of an air transport object (ATO) of the UAV type. Specifically, it is the sphere of rescue services in a predefined local area of the Slovak mountains. The lecture describes avionic control and navigation systems by analogy, which form part of unmanned aerial vehicles, focusing on the autonomy of the specified flight. The use of an unmanned aerial vehicle is set in the mountainous area of the High Tatras, where random manifestations of air mass movements predominate. The lecture's content is connected with the need to develop a new legislative issue, which should be different from the legislative regulations of the PPL pilot. The results achieved so far presented summary information on the methodological approach to the local control of an unmanned aerial vehicle of the UAV type - they solve the readiness of the UAV for local flight and the method of remote control in mountainous terrain. Models of random UAV errors, navigation and operator guidance along the selected route contain assumptions of skill for UAV operators when intervening in the area of anticipated rescue. This points to the econometrics and efficiency of the reliability of air transport. The developed issues are oriented toward developing science and research in the given working environment of autonomous management of ATO and dichotomous learning of air operators.

IS07
Distributed Autonomous Separation Assurance with Deep Multi-Agent Reinforcement Learning

Peng Wei, Assistant Professor

George Washington University, USA

Abstract: Urban Air Mobility (UAM) is an envisioned air transportation concept, where eletrified and autonomous flying machines could safely and efficiently transport passengers and cargo within urban areas by rising above traffic congestion on the ground. How can we design and build a real-time, trustworthy, safety-critical autonomous UAM separation assurance tool to enable large-scale flight operations in high-density, dynamic and complex urban airspace environments? In this talk the speaker will present studies to address this critical research challenge using multi-agent reinforcement learning and attention networks.

IS08
INS-MEMS/GPS Integrated Systems Based Artificial Intelligence Algorithms for Navigation in GPS Challenging Environments

Prof. eng. Teodor Lucian Grigorie– PhD Habil

Military Technical Academy "Ferdinand I" in Bucharest, Romania

Abstract: GPS is the most widespread GNSS in the world and applies successfully in so many fields such as positioning, navigation, geodesy, mapping, timing and so on. Unfortunately, navigation accuracy and integrity of GPS are degraded in the presence of radio frequency interference, hostile jamming and high dynamical situations, when the satellite signals may get lost due to signal blockage. On the other hand, INSs can address this problem and overcome the non-availability of GPS signals for a short period of time due to the inherent sensors errors. The main shortcoming is that the INS accuracy degrades greatly over time. In such case, INSs can benefit from aiding such as GPS. As the increasing use of low-cost Micro-Electro-Mechanical System (MEMS) inertial sensors to navigation applications, however, the traditional Kalman filter methodology was found insufficient due to poor quality of the MEMS inertial measurements. To overcome or reduce the impact of the Kalman filter limitations an identified solution in the literature is related to the incorporation of artificial intelligence algorithms for developing INS/GPS integration. The current presentation targets to expose a way to overcome the limitations of current INS/GPS integration schemes and to improve the positioning accuracy during GPS signal blockages. The proposed solution is fitted in a new research trend regarding the using of Adaptive-Neuro-Fuzzy-inference system (ANFIS) techniques to obtain high precision low-cost INS/GPS integrated navigation systems. Some intelligent data fusion algorithms based ANFIS are developed in order to predict the mislaid GPS reading data and the positioning errors during GPS signal outages.

IS09
Solar-powered UAV for Environmental Monitoring Applications

Vis Sripawadkul, Mr.

Kasetsart University, Thailand

Abstract: To promote the development of renewable energy in Thailand, a small solar-powered unmanned aerial vehicle has been developed for environmental monitoring application. We explored an alternative design of this solar-powered UAV by aiming to achieve continuous flight. The type of PV cells, geometric design parameter, as well as number of motors have been compared. A hybrid solar powered UAV is predicted for 6-hour non-stop flight operation under Thailand weather condition.

005
The Effects of Total Initial Concentration in A Vanadium Redox Flow Battery

İlkerKayalı[1,2]

[1]*Erciyes University, Kayseri, Turkey*
[2]*Kapadokya University, Nevşehir, Turkey*

Abstract: The effects of total initial concentration in vanadium redox flow battery (VRFB) are investigated by using two-dimensional and steady-state for during discharge cycle. The model is solved using COMSOL Multiphysics 5.5 with the equations of mass, charge, momentum and energy conservation. Cell voltage, overpotential and temperature distribution are investigated for 1040 mol/m3, 1500 mol/m3 and 1700 mol/m3 total initial concentration. The results reveal that the overpotential decreases, while the temperature distribution and cell voltage increase with the increase of the total initial concentration. Moreover, the positive electrode is occured higher over-potential and temperature distribution than the negative electrode.

Keywords: Vanadium redox flow battery, initial concentration, over-potential, temperature distribution.

010
Two-Phase Heat Exchangers for Thermal Control of Electric Aircraft Equipment

Leonard Vasiliev[1] and Alexander Zhuravlyov[1]

[1]*Luikov Heat and Mass Transfer Institute, Minsk, Belarus*

Abstract: Thermal control systems based on two-phase heat transfer devices providing efficient removal of excess heat from cooled objects are considered. The heat pipes and thermosyphons are autonomous and noiseless. Their operation does not require energy consumption. These devices can take heat from the object to be cooled, remove it outside the volume filled by the equipment, and then transfer it to the coolant or air. The attractiveness of two-phase passive heat transfer for use in electric and hybrid aircrafts is noted. With a help of heat pipes and loop thermosyphons it is possible to equalize the battery temperature by transferring heat from its modules to a liquid cooling system. A possibility to successfully remove heat from a rotor and stator of an electric motor is analyzed and discussed. A rotor of an electric engine can be cooled using rotating centrifugal heat pipes (vapor chambers). The heat pipe cooling system is attractive due to its simple and reliable design, moving parts absence, and the relatively low weight of the device.

Keywords: Electric aircraft, heat exchange, cooling, heat pipe, thermosyphon.

015
Acoustic Operational Monitoring of Unmanned Aerial Vehicles' Near Vertiports

Vitalii Makarenko[1] and Vadim Tokarev[1]

[1]*National Aviation University, Kyiv, Ukraine*

Abstract: Operational safety will become of a prime concern, as many of UAS would fly close to residential areas. This paper is devoted to small UAS (sUAS) collision risk with static ground objects in populated zones. Solutions of sense and avoid problem involve the use of a passive localization method to detect collision threats. This method uses the acoustic signature of the UAS. The method is based on resampling of received signals of moving UAS for Doppler shift compensation, evaluation of generalized cross-correlation with phase transforms and signal delays grouping using cyclic sums and products.

Keywords: Urban air mobility, small unmanned aerial systems, collision avoidance, acoustic array.

016
Design Considerations for Hybrid-Electric Propulsion Systems for FW-VTOL Aircraft

Daniele Obertino[1], Phillip Sharikov[2], Jay Matlock[2], Afzal Suleman[2]

[1]*Instituto Superior Técnico, Lisbon, Portugal*
[2] *University of Victoria,Victoria,Canada*

Abstract: This paper aims to present the ongoing research effort on hybrid-propulsion unmanned aerial vehicles (UAVs) carried out at the University of Victoria Centre for Aerospace Research (UVIC-CfAR). The study involves the development and updating of an optimization framework capable of evaluating vertical take-off and landing (VTOL) and conventional take-off and landing (CTOL) unmanned aerial vehicle (UAV) hybrid propulsion performances, with a recent focus on more unconventional configurations mounting fuel cells onboard. A preliminary sizing and mass analysis for the hybrid propulsion system of a UAV with VTOL capabilities was accomplished. A similar analysis was also performed for a CTOL configuration powered by hybrid fuel cell schemes. Finally, a hybrid test bench used to validate the models and test the components is presented. The paper concludes with the general statement that for small UAVs, a hybrid power plant can lead to improvements in endurance, fuel consumption, and efficiency along the mission.

Keywords: Glitter belt, flying leaf, flying leaflet, solar reflection, UAV.

019
Flight Testing and Simulation of High Altitude Reflector Components

Narayanan M. Komerath[1], Ravi Deepak[1], and Adarsh Deepak[1]

[1]*Georgia Institute of Technology, Atlanta, United States*

Abstract: The Glitter Belt architecture consists of high-altitude reflector swarms reducing insolation. Flying Leaflet (FLT) carriers deliver reflective sheets to 30.5km and power the sheets to sustain flight indefinitely. Flying Leaf (FL) high-aspect ratio vehicles comprise 11 deployed sheets, supported by 3 FLTs. Small scale testing and dynamic flight simulation are used to remove uncertainties and explore craft geometry. The target for full-scale FL of 700m span is wing loading of 1.25 N/m^2. Wind tunnel tests proved FLT geometry for sheet stability. Flights demonstrate static stability of FL and FLT geometries at 1m to 2m scale in glide, and sustained powered flight. Flight dynamic simulation of a 16m FLT model validate the conceptual design from sea level to 36 km.

Keywords: Glitter belt, flying leaf, flying leaflet, solar reflection, UAV.

020
Sustainable Aviation of a Leather Industry: Life Cycle Assessment of Raw Materials, Energy Consumption and Discharge of Pollutants and Recovery of Some Economical Merit Substances

Delia Teresa Sponza[1], Nefise Erdinçmer[1]

[1]*Dokuz Eylül University, Izmir, Turkey*

Abstract: The aim of this study was to evaluate the environmental effect of a leather industry by applying the Life Cycle Assessment protocols. In this study life cycle inventory analysis (LCI) refers to the quantitative substituents like energy, discharge of pollutant waste within the system's boundary, covering all the processes and activities of the industry. Life cycle assessment (LCA) is an accepted methodology for a decision-making tool for the assessment of environmental burdens associated with production processes towards sustainable aviation in leather industry. The environmental links were embedded within leather industry in terms of energy consumption, material utilization and environmental waste emissions.

Keywords: Sustainable aviation, leather industry, life cycle assessment, recovery.

021
Aircraft Noise Measurements in Ukrainian Airports

O. Zaporozhets[1], V. Gulevets[1], S. Karpenko[1], K. Kazhan[1], O. Konovalova[1], V. Paraschanov[1]

[1]National Aviation University, Kyiv, Ukraine

Abstract: The paper presents an overview of instrumental measurements of aircraft noise are performed in accordance with the requirements of the guidelines to the aviation rules of Ukraine "Requirements for operators related to noise zoning of the airport vicinity" AR-381-2019. The results of measurements are used for proving of aircraft noise contour calculations, especially used for boundaries of noise zoning around the airports.

Keywords: Aircraft noise, zoning, airport, measurements, calculations.

022
Automation Level Impact on The Operators (Pilot, Air Traffic Controller)' Role and Total Loads

Abeer Jazzar[1], Omar Alharasees[1], and Utku Kale[1]

[1]Budapest University of Technology and Economics, Budapest, Hungary

Abstract: Present aviation operations are heavily reliant on highly automated systems for low risk, safe, balanced operator total loads and efficient operations. Automation helps the operators understand the system status better by alerting and indicating any abnormalities. It also helps in reducing/eliminating repetitive tasks, allowing the operator to focus on critical ones. However, highly automated systems can result in swamping the operator with information which could prevent them from making the right choice in a short time. Additionally, automation is changing the operators' role from active operations to passive monitoring. That might potentially decrease the operators' situational awareness and could even affect the operators' required skills for the aviation industry. Thus, potentially, it will lead to a dangerous situation if the system fails and needs human interventions. This study focuses on understanding and investigating the effects of automation levels on the operators' total loads (Work, Task, Information, Communication, Mental) by carrying a questionnaire for ATCOs and Pilots based on their experience. In this study, 62 responses are collected from pilots and ATCOs that vary in 27 countries, with approximately 26% being ATCOs and 56% being pilots, and 10% being ATCO & Pilot. Based on the results of this questionnaire and the responses feedbacks, the study suggests: (i) improving aviation training by constantly revising it to keep up with the advanced technologies. (ii) balancing the total loads and using human duality in operation. (iii) adapting the new advanced technologies and always following the standard operating procedure in aviation worldwide to achieve efficient and safe operations.

Keywords: Automation, operator total loads, operators, human factor, load management.

025
Misunderstandings in Aviation Communication

Omar Alharasees[1], Abeer Jazzar[1], and Utku Kale[1]

[1]*Budapest University of Technology and Economics, Budapest, Hungary*

Abstract: The consequences of ineffective communication can be life-threatening and dramatic. Communication misunderstandings are often cited as the cause of paranormal events in aviation which could lead to accidents/incidents. As a result, the risk of lack of communication is relatively high. Many factors that directly or indirectly influence the rate of misunderstandings in communication, such as language barriers, non-standardized Phraseology, ambiguous communication, regional differences, and premature communication, are the causes of communication errors in flight. the study focuses on distinguishing and emphasizing various perspectives of communication and making suggestions to operators to reduce misunderstandings in aviation communications. the study is based on a survey highlighting the important communication loads such as flight training, standard expressions, operator's native language, and cultural background. The survey collected 110 responses from pilots and ATCOs, from various countries, with approximately 20% being ATCOs and 75% being pilots. Some suggestions concluded based on the results of this study, (i) improving aviation training by further focusing on radiotelephony communications, and (ii) familiarizing and permanently updating standard used phraseology among operators.

Keywords: Communication, operator total load, radiotelephony, misunderstanding.

027
Resampling Based Particle Filter Estimation of a Quadrotor

Aziz Kaba[1] and Ahmet Ermeydan[1]

[1]*Eskişehir Technical University, Eskişehir, Turkey*

Abstract: Quadrotors have dynamic nonlinearities, coupling effects and unstable open – loop characteristics. Control of quadrotors are still an open issue. Flight controller reads the sensor outputs to calculate the attitude angles. However, unmanned aerial vehicles are prone to sensor noises and disturbances. In order to control a quadrotor, its states must be effectively estimated. So, in this work resampling based particle filter is presented and effect of particle size is investigated for attitude estimation problem of a quadrotor.

Keywords: Quadrotor, UAV, particle filter, resampling, particle size

028
An Evaluation of the Usage of Solar Photovoltaic Panels in Aviation

Koray Oncel[1] and Fatih Serttas[1]

[1]Afyon Kocatepe University, Afyon, Turkey

Abstract: Nowadays, it is no longer easy to reach the energy that the whole world needs in almost every field. One of the biggest reasons for this is that the need for energy has dramatically increased with the increasing population, developing technology, and industry branches. In order to meet such a strong consumption demand, using the resources we have most efficiently and making smart environmental investments supports both the aim of protecting nature and making a profit on an industry basis by contributing to sustainability. For this purpose, the advantages and disadvantages of meeting the energy with photovoltaic panels in aviation, one of the most complex industries that consume energy 24 hours a day, are investigated.

Keywords: Photovoltaic panels, sustainable aviation, solar power.

031
Examination of Different Systems Used for UAV Detection and Tracking

Alpaslan Durmuş

Ostim Technical University, Ankara, Turkey

Abstract: The use of unmanned aerial vehicles (UAV) has increased rapidly in recent years and has become widespread. The reason for this is that UAV systems are cost-effective compared to many aircraft and their maintenance costs are relatively lower. Of course, the prevalence of UAV systems in our daily lives in such a short time brings security threats. In recent years, different systems have been used to prevent security threats from UAV systems. These systems are classified as radar systems, acoustic detection technologies, radio frequency (RF) emission detection applications and Electro-Optical (EO) detection methods. These systems have different advantages and disadvantages. In this study, UAV detection and monitoring applications that can be used to prevent security threats that may arise from UAV systems, which are expected to become more widespread with the stretching of regulations in the next 5 years, are examined. At the same time, the advantages and disadvantages of different UAV detection and tracking applications were examined and tips were presented to the designers.

Keywords: UAV detection and tracking systems, radar, RF, acoustic, electro-optic.

032
Modeling of Exhaust Gases Jet from Aircraft Engine for Different Operational Conditions

Kateryna Synylo

National Aviation University, Kyiv, Ukraine

Abstract: Emission inventories analysis at European and Ukrainian airports highlighted, that aircraft is a dominant source of air pollution. To evaluate the aircraft contribution in airport air quality it is important to take in mind some features of the aircraft, as special source of air pollution. The most part of landing-take-off cycle the aircraft is maneuvering on the ground, it is subjected to fluid flow that can create a strong vortex between the ground and engine nozzle, which have essential influence on structure and basic mechanisms of exhaust gases jet from aircraft engine. The paper demonstrates the results of CFD modeling and analysis for the jets close to ground surface, simulating the aircraft engine jets' performances in airport. The numerical simulation of wall jet by Fluent 6.3 was implemented for different combination of initial jet velocity and height of engine installation to evaluate the influence of the ground on jet's parameters (height and longitudinal coordinate of buoyancy effect, length of jet penetration). Obtained results provide improvement of PolEmiCa model.

Keywords: Air pollution, aircraft engine emissions, local air quality, aircraft engine exhaust gases jet, numerical simulations of jet.

033
Peculiarities of Pre-Processing of ADS-B Data for Aircraft Noise Modeling and Measurement During Specific Stages of LTO Cycle

K. Kazhan[1], O. Zaporozhets[1], S. Karpenko[1]

[1]National Aviation University, Kyiv, Ukrain

Abstract: The paper is targeted at the analysis of the importance of ADS-B data in the terms of overcoming gaps between noise modeling results and short or long-term measurements. Presented results based on noise measurement campaign at Ukrainian airports describe general peculiarities of the pre-processing of ADS-B data during specific stages of LTO cycle. The paper outcomes could be used for preparation to noise measurements and development of recommendations for noise monitoring system.

Keywords: Aircraft noise, airport, noise modeling, measurement.

034
Influence of Battery Aging on Energy Management Strategy

Teresa Donateo[1], Ludovica Spada Chiodo[1], and Antonio Ficarella[1]

[1]*University of Salento, Lecce, Italy*

Abstract: In the context of Hybrid Electric Propulsion Systems, one of the main aspects to investigate is the most suitable energy management strategy, which would allow the objectives of fuel consumption minimization and electric backup availability to be attained. The present study aims to compare two different energy management strategies for a Hybrid Electric Propulsion System (HEPS) for an Air-Taxi vehicle: though both are based on the same set fuzzy rules, the first one has been implemented neglecting battery aging effects, while the second adjusts the optimal battery discharge according to its age. The impact of such adaptation on fuel consumption and battery State of Charge will be evaluated along a typical mission profile.

Keywords: Hybrid electric vehicles, Energy management, Battery aging.

035
Application of PMV in the Evaluation of the Aircraft Passenger Cabin Thermal Environment

Eusébio Conceição[1], M.Inês Conceição[2], M. Manuela Lúcio[1] , João Gomes[3], and Hazim Awbi[4]

[1]*Universidade do Algarve, Faro, Portugal*
[2]*Universidade de lisboa, Lisboa, Portugal*
[3]*Campus de Gambelas, Faro, Portugal*
[4]*University of Reading, United Kingdom*

Abstract: The application of PMV in the evaluation of the aircraft passenger cabin thermal environment is made in this work. The numerical work consider a software that simulate the Aircraft Passenger Cabin Thermal Environment numerical model and a coupling of a software that simulate the airflow around the occupant and the human thermal response. The work is made inside a virtual chamber equipped with an inlet system, based personalized ventilation system, and an exhaust system. The personalized ventilation system is located in front the trunk of the occupant and the exhaust located above the passenger head level.

Keywords: Thermal comfort, PMV, PPD.

036
Evaluation of HVAC System Performance in an Aircraft Passenger Cabin

Eusébio Conceição[1], M.Inês Conceição2, M. Manuela Lúcio[1], João Gomes[3], and Hazim Awbi[4]

[1]*Universidade do Algarve, Faro, Portugal*
[2]*Universidade de lisboa, Lisboa, Portugal*
[3]*Campus de Gambelas, Faro, Portugal*
[4]*University of Reading, United Kingdom*

Abstract: The evaluation of HVAC (Heating Ventilating and Air Conditioning) system performance in an aircraft passenger cabin, using the Air Distribution Index (ADI), is carried out in the present paper. ADI depends of the thermal comfort level, the indoor air quality level, the effectiveness for heat removal and the effectiveness for contaminant removal. This numerical study was done using a coupling between a Computer Fluid Dynamics and a Human Thermal Response numerical models which use data input from an Aircraft Passenger Cabin numerical model. Six cases were analysed, each characterized by a different internal air temperature at the entrance to the HVAC. The best performance of the HVAC system was obtained for the case that presented an average ADI value of 6.85.

Keywords: ADI, thermal comfort number, indoor air quality number, PPD, CO_2 concentration.

037
Design of Aircraft Wings and Wind Turbine Blades

EusébioConceição1, M.Inês Conceição2, M. Manuela Lúcio[1], João Gomes[3], and Hazim Awbi[4]

[1]*Universidade do Algarve, Faro, Portugal*
[2]*Universidade de lisboa, Lisboa, Portugal*
[3]*Campus de Gambelas, Faro, Portugal*
[4]*University of Reading, United Kingdom*

Abstract: In this study is developed a numerical model that is used to design the Aircraft Wings and Wind Turbine Blades. The design, using a numerical methodology of the blades geometry, is made through the Computer Aid Design using a coupling between the numerical software, that calculate the three-dimensional geometry, and the numerical software, that represent three-dimensional geometry.

Keywords: Design, aircraft wings, wind turbine blades

040
Latest Developments on Electrical Air Vehicles Powered by Electric and Hybrid Propulsion Systems

Ozgur Balli[1,2], Alper Dalkiran[3,4], T. Hikmet Karakoc[5,6]

[1]*1'st Air Maintenance Factory Directorate (1.HBFM), General Directorate, Eskisehir, Turkey.*
[2]*Eskisehir Osmangazi University, Eskisehir, Turkey.*
[3]*Suleyman Demirel University, Isparta, Turkey*
[4]*ATAP Technopark, Eskisehir, Turkey*
[5]*Eskisehir Technical University, Eskisehir, Turkey*
[6]*ATAP Technopark, Eskisehir, Turkey*

Abstract: Aviation pioneers have been studying disruptive technologies in propulsion egineering throughout recent years. In this study, the recent developments on electrical air vehicles powered by electric and hybrid propulsion systems that seem to be the driving force for modern and sustainable aviation are investigated in detail.

Keywords:

043
An Examination of the Usage Areas of Big Data Technology in Civil Aviation

Betul Kacar[1] and Emre Nalcacigil[1]

[1]*Cappadocia University, Nevsehir, Turkey*

Abstract: It is an extremely important issue to adapt to the changing industry conditions in the aviation sector, which is one of the most complex sectors where intense competition is felt globally. In order to ensure and maintain customer satisfaction, maintain business profitability and provide a competitive advantage, it is also necessary to understand the areas of use of big data in the aviation sector. In this study, after a general review of the concept of big data, the application areas of big data in aviation were discussed. In the results and discussions section, the application difficulties of the concept of big data, which has great advantages, were focused on.

Keywords: Civil aviation, big data, big data analytics, efficiency in the aviation industry.

044
Particle Image Velocimetry Measurement with Scaled-Down Aircraft Models: A Review of the Experiments and Applications

Murat Ayar[1,2], Ali Haydar Ercan[3], Tahir Hikmet Karakoc[1,4]

[1]*Eskisehir Technical University, Eskisehir, Turkey*
[2]*ATAP Technopark, Eskisehir, Turkey*
[3] *Eskisehir Technical University, Eskisehir, Turkey*
[4]*ATAP Technopark, Eskisehir, Turkey*

Abstract: Aerodynamic tests in wind tunnels are one of the methods used in determining the performance of aircraft during the design phase. The Particle Image Velocimetry method is the closest to real-world flow visualization to detect velocity fields and vortex formations in wind tunnels. In this method, models that are scaled-down of the physical dimensions of the aircraft are used. In the experiments, the model should be used under the dimensions of the wind tunnel test section, the characteristics of the wind tunnel, and the flow characteristics to be examined. The relationships between these two variables were investigated in flow visualization studies using scale models. As a result, predictions and suggestions were made about using scale models.

Keywords: Particle image velocimetry, scaled-down models, wind tunnels.

045
PIV Experimental Setup Integrated Wind Tunnel Initial Design: Size and Power Requirement Calculation

Murat Ayar[1,2], Tahir Hikmet Karakoc[1,3]

[1]*Eskisehir Technical University, Eskisehir, Turkey*
[2]*Technopark, Eskisehir, Turkey*
[3]*ATAP Technopark, Eskisehir, Turkey*

Abstract: Aerodynamic forces and moments act on all kinds of vehicles and structures that move in the air or are under the influence of an air current. Wind tunnels are used to find these forces and determine the shape and form of the flow. It is used to examine the aerodynamic structure, parameters such as heat, light, and smoke on the one-to-one product or scaled-down products placed in the wind tunnel under desired conditions. Particle Image Velocimetry (PIV) is used to detect flow velocity fields and eddy formations. Systems integrated into the wind tunnel should be created to use the PIV method, especially in aviation applications. In this study, a wind tunnel was designed for the easy-access and modular test section in the PIV system. The results of the study showed the tunnel dimensions and the power requirement.

Keywords: Particle image velocimetry, wind tunnel design, aerodynamics.

047
Imaging Techniques Based on Unmanned Aerial Vehicle

Alpaslan Durmuş[1], Abdulhamit Sevgi[1], Cebrail Ölmez[1]

[1]*Ostim Technical University, Ankara, Turkey*

Abstract: The widespread use of unmanned aerial vehicles (UAVs) in civilian areas in recent years has led to great progress in photogrammetry and remote sensing. manned aircraft etc. UAV systems have many promising features: flexibility, efficiency, high spatial/temporal resolution, low cost, ease of use, etc. With these advantages of UAVs, UAV-based aerial images are taken, processed, analyzed, etc. work started to gain momentum day by day. Various use case examples of UAV aerial imagery studies are among the ongoing studies. As a result of such developments, UAVs have started to become standard platforms for applications aiming to capture photogrammetric data. Within the scope of this study, UAV-based photogrammetry and remote sensing systems and data collection techniques and applications are examined and the efficiency and quality of the latest technology digital aerial camera systems are discussed.

Keywords: Unmanned aerial vehicle (UAV); remote sensing; photogrammetry; earth observation.

048
Possibilities of Using Fuel Cells in Transport Aircraft

Marian Hocko[1], Samer Al-Rabeei[1], and Utku Kale[2]

[1]*Technical University of Kosice, Rampová, Kosice, Slovakia*
[2]*Budapest University of Technology and Economics, Budapest, Hungary*

Abstract: The article focuses on the possibility of reducing harmful emissions from commercial aircraft using hydrogen fuel cells. The possibilities of using fuel cells in the construction of current transport aircraft are indicated by specific examples.

Keywords: Aviation emissions, clean Sky, hydrogen combustion, aviation fuel cell, APU.

049
Aircraft Accidents and Their Causes

Samer Al-Rabeei[1], Simona Pjurová[1], Utku Kale[2]

[1]*Technical University of Kosice, Rampová, Kosice, Slovakia*
[2]*Budapest University of Technology and Economics, Budapest, Hungary*

Abstract: Number of accidents with fatal consequences is falling lower with each decade since 1950s, which is noteworthy accomplishment if we take into account constantly growing frequency of air travel. While in 1949, there were 40 fatal accidents in total per one million departures, during next decades this number significantly dropped to less than two accidents per one million departures. According to IATA, civil aviation safety is still on the lowest rate in history based on current number of accidents per one million departures. This improvement in safety is based on number of factors. Reliability of jet engines has huge impact on this safety. Other than that, improvements in sensors, navigation and air traffic control technology are one of these factors too. Last but not least, reducing human error during crew and cockpit management and data monitoring is one of the most important improvements in recent decades. The aviation industry's remarkable record of safety during the last years in mostly thanks to big technological leaps during second half on 20th century.

Keywords: Air transport, safety, aircraft, accidents, failure.

050
Conceptual Application of Hybrid-Electric Propulsion System Configurations on Cessna 172S

Burak Akgul[1] and İsmail Ata[1]

[1]*Erciyes University, Kayseri, Turkey*

Abstract: In this paper, two hybrid-electric propulsion system configurations are presented as an example of hybrid-electric propulsion systems in order to decrease fuel consumption, greenhouse gas emissions and flight costs. Today most academic papers about electrified propulsion are theoretical, therefore conceptual applications with commercially available technologies have been implemented on the Cessna 172S, which is a very common aircraft, in order to understand the current state of electrification. In two hours conceptual flight, 14.8% reduction in fuel consumption and flight greenhouse gas emissions; and also nearly 14% cost reduction were achieved with battery hybrid-electric and fuel cell hybrid-electric propulsion system configurations.

Keywords: Electric aircraft, hybrid-electric aircraft, electrified propulsion.

051
Subjective Decision-Making of Aviation Operators (Pilots, ATCOs)

Utku Kale[1], Omar Alharasees[1], Joszef Rohács[1] and Dániel Rohács[1]

[1]*Budapest University of Technology and Economics, Budapest, Hungary*

Abstract: In aviation working environment it is really important that operators (Pilots, ATCOs) make optimum judgments and a timely decision under different subjective work scenarios, which is influenced by a variety of factors such as skills, experience level and the human response factor. By applying a novel generalized model that employ the operator's environmental and physical conditions. The study explored the endogenous dynamics of the pilot abilities of decision-making under varied experiences and skills. Using the modified Lorenz attractor on MATLAB for modelling for comparing the subjective decision-making of pilots for the following experience levels: (i) pilot cadets, (ii) less-skilled pilots, (iii) skilled pilots, and (iv) expert pilots. For two flight tasks: landing and go-around circumstances. The "Hesitation frequency" and "decision-making time" were calculated during the final approach. In addition, this research investigated several specific aspects of operators that influences the aviation safety.

Keywords: Subjective decision-making, situation awareness, operator dynamic response, aviation safety, operators total load, human factor.

052
Test Bench for Electric Propellers and Distributed Propulsion

Castroviejo Daniel[1] and Patrick Hendrick[1]

[1]*Université Libre de Bruxelles*

Abstract: In the quest for a sustainable aviation many new innovations are taking place while other old technologies are being revised. Such is the case of distributed electric propulsion. For this type of technology (the same used as on the NASA N3-X for instance), ducted propellers are used to increase overall efficiency and aerodynamic performance of the aircraft. It is no doubt that electric distributed propulsion has some advantages over classic propulsion configurations such as for instance improved maneuverability, control surfaces area reduction and hence weight reduction, boundary layer ingestion and more. In this paper it is the effect of the duct over the propeller efficiency which will be quantified. To do so, a test bench equipped with high resolution sensors has been built to effectively test, measure and analyze electric drone propellers in different configurations. This has allowed to quantify the increase in performance the installation of a simple duct can bring. A further study should be conducted to quantify the induced drag due to the duct in order to compare positive and negative effects.

Keywords: Electric ducted fans, drones, distributed propulsion, efficiency.

056
Increase of Engine Characteristics by Using of Alcohol Converting

Sviatoslav Kryshtopa[1], Liudmyla Kryshtopa[1], Ruslans Šmigins[2], Volodymyr Korohodskyi[3], Myroslav Panchuk[1], Igor Prunko[1]

[1]*National Technical University of Oil and Gas, Ivano-Frankivsk, Ukraine*
[2]*Latvia University of Life Sciences and Technologies, Jelgava, Latvia*
[3]*National Automobile and Highway University, Kharkiv, Ukraine*

Abstract: The work is aimed at solving the problem of converting diesel engines to gas fuels, which are cheaper to diesel fuel. Alternative methanol fuel has been chosen as initial product for converting process and its cost, temperature conditions have been taken into account. Fuel energies were increased due to thermal regeneration of exhaust waste gas heat. Calculations showed that the thermochemical effect from combustion of the converted mixture of carbon monoxide and hydrogen exceeds the effect from combustion of the same amount of non-convertible alcohol. Experimental studies have shown that converting of diesel engines to work using methanol products is technically reasonable. Fuel consumption reduction was accompanied by environmental performance betterment of the engine working together with a thermal alcohol reactor. Formation of NOx in the exhaust waste gases decreased by 53-60 %, CO occurred in the range of 52-62 % according to the loading and crankshaft speed on the engine. Converting of engines for alcohol converting products is very profitable because the price of methanol is, on average, 10-20 % of the cost of diesel fuel.

Keywords: Diesel engine; alternative fuel; alcohol converting, nitrogen oxides; exhaust waste gases; carbon monoxide.

057
Use of Polyfunctional Additives as a Part of Motor Fuels and Lubricants

Andrii Grigorov[1] and Alexander Trotsenko[1]

[1]*National Technical University, Kharkiv, Ukraine*

Abstract: The possibility of using 1,3 - diphenyltriazene as a multifunctional additive to motor fuels and lubricants is considered in the article. The impact of the additive on the ecological, operational and physicochemical properties of motor fuels is theoretically substantiated. It was found that the addition of 1% mass. of 1,3 - diphenyltriazene to straight-run gasoline and diesel fractions promotes their stable color (from yellow to red), which can be used in the fight against counterfeiting of petroleum products; reduce of soot and hydrocarbon content in exhaust gases; increase by 11 points of octane number of gasoline and 6 points of cetane number of diesel fraction.

Keywords: Motor fuel, lubricant, fraction, additive, 1,3 –diphenyltriazene.

058
Modern Tendencies in Improvement of Technologies of Utilization of the Fulfilled Tires

Sergii Boichenko[1], Anna Yakovlieva[2], Iryna Shkilniuk[2], Igor Kubersky[1]

[1]National Technical University of Ukraine, Kyiv, Ukraine
[2]National Aviation University; Scientific, Kyiv, Ukraine

Abstract: The study presents a complex analysis of the state of tecnologies for waste tires utilization. The statistical analysis of transport tires use and waste transport tires accumulation is done. The negative impact of tires accumulation and storage in the environment is considered. The perspective methods of waste tires utilization are presented and considered. Advantages and disadvantages of the presented technologies are discussed. Technological, economical, and environmental issues of technologies of tores recycling are analyzed and considered. The most feasible ways for tores disposal are proposed.

Keywords: Waste tires, chemical processing, physical processing, energy extraction, pyrolisis.

059
Determination of Environmental Impact Assessment Criteria in the Life Cycle of Transport Facilities

Victoria Khrutba[1], Inessa Rutkovska[1], Tatiana Morozova[1], Lesya Kriukovska[1] and Natasha Kharitonova[2]

[1]National Transport University, Kyiv, Ukraine
[2]State Enterprise, Kyiv, Ukraine

Abstract: The paper proposes a list of criteria for environmental impact assessment in construction and reconstruction projects of transport facilities. The list of criteria includes - impact on the quality of the surface layer of atmospheric air; volume of consumption of non-renewable resources; impact on the quality of the aquatic environment; waste management efficiency indicator; impact on the quality of land resources; impact on the quality of the geological environment; physical factors influencing the environment; impact on flora and fauna, protected objects; impact of TF on the social environment; impact of the transport structure on the man-made environment. Each of the criteria is a set of local indicators. The method of quantitative evaluation of these criteria has been developed, which provides for expert evaluation of each criterion according to the proposed scale. The method was implemented during the environmental impact assessment of the project "Construction of a state road H-31 Dnipro - Tsarychanka - Kobeliaky - Reshetylivka from the village of Loboykivka to the border of Dnipropetrovsk region I-b technical category with 4 lanes bypassing Loboykivka, Petrykivka, Mohyliv, Kitaygorod, Tsarychanka, Lyashkivka". The example of defining certain criteria for the impact of this project on the environment is given.

Keywords: Environmental impact assessment, transport facility, highway, environmental impact criteria, quantitative indicators.

060
Obtaining of Urea Greases Basis on Vegetable Oils

Oleg Safronov[1], Larysa Bodachivska[1], Iryna Venger[1], Oleksii Papeikin[1]

[1]V.P. Kukhar Institute of Bioorganic Chemistry and Petrochemistry of the National Academy of Sciences of Ukraine, Kiyv, Ukraine

Abstract: The paper presents a new method for obtaining urea greases based on vegetable oils by amidation with ethylenediamine and condensation with polyisocyanate.

Keywords: Urea greases, vegetable oils, amidation, condensation.

061
Modern Tendencies in Improvement of Technologies of Utilization of the Fulfilled Tires

Serhii Konovalov[1], Stepan Zubenko[1], Lyubov Patrylak[1], Anjela Yakovenko[1], Volodymyr Povazhnyi[1], Kateryna Burlachenko[1]

[1]V.P. Kukhar Institute of Bioorganic Chemistry and Petrochemistry of National Academy of Sciences of Ukraine

Abstract: Fatty acid ethyl and butyl esters looks promising as possible blending biocomponents for jet fuels. This work deals with the alkaline transesterification of wasted frying oils (free fatty acid content up to 2.5 %) by ethyl and n-butyl alcohols, using alkoxides' catalytic solutions, prepared from only hydroxide and alcohols. The favorable synthetic conditions, providing high yield and effective self-separation, was found. Such conditions combine slightly decreased reaction temperature, short synthesis duration, low excess of alcohol and relatively high alkoxides' load. It was observed the sedimentation of the large part of glycerol and alkaline catalyst as the primary high-pure glycerol layer, which almost doesn't contain esters and soaps. It looks promising the possibility of reuse of such glycerol layer for alkaline catalysis of oil's transesterification of for another synthetic purposes.

Keywords: Ethyl esters, butyl esters, alkoxides, transesterification, wasted frying oil, glycerol layer.

062
Applications of Drone Control & Management in Urban Planning

Dinh-Dung Nguyen[1], Utku Kale[2], Muhammed Safa Baş[3], Munevver Ugur[4], and T. Hikmet Karakoc[4]

[1]*Le Quy Don Technical University, Hanoi, Vietnam*
[2]*Budapest University of Technology and Economics, Budapest, Hungary*
[3]*University of Debrecen, Faculty of Engineering, Debrecen, Hungary*
[4]*Eskişehir Technical University, Eskişehir, Turkey*

Abstract: Drones or Unmanned Aerial Systems (UAV - Unmanned Aerial Vehicles or UAS - Unmanned Aerial Systems) are vehicles that can fly without the need for a pilot or passengers. Drones can be controlled remotely through radio waves or independently (with a route determined before). The amount of documented accident that involves the hazardous use of drones has risen significantly as a result of the increased usage of drones. To perform and increase the use of drones in air traffic management (ATM), especially in smart city planning, a variety of regulations and management procedures will be implemented. The aim of this paper is to propose management rules or regulations for drones in smart city transportation management, as well as some approaches related to drone management and drone control. To present controlling approaches through the parameters in mathematical modeling for drones, we need a control rule and a dynamic model of drones, and to present controlling and managing it with the help of a drone-following model based on a dynamic model of drones.

Keywords: Drones, drone management, safe distance, following model.

063
Observed Engine Take-off Performance with Ambient Temperature Using Real Flight Data on Boeing 787-8 Aircraft

Tapdig Imanov[1] and Melih Yildiz[2]

[1]*Cyprus Science University, Kyrenia, TRNC*
[2]*Erciyez University, Kayseri, Turkey*

Abstract: Climate change is a reality for today. The warming temperature value for Azerbaijan is already around 1.6 ˚C. In this study, real flight data collected by Enhanced Airborne Flight Recorder of Boeing 787-8 aircraft, flight parameters and engine performance are analyzed. It is seen that while the EGT is directly related to fuel flow, ambient temperature has a strong effect to increase the EGT further than the MTOW of the aircraft. This causes the engine to be used in a limited performance, decreased life cycle and increased maintenance cost of the engine.

Keywords: Takeoff performance, ambient temperature, EGT, fuel flow.

064
Polarization Effect Between Entropy and Sustainability of Cruise Altitude for Jet-prop Engine Performance

Mehmet Ziya Söğüt

Piri Reis University, İstanbul, Turkey

Abstract: Entropy and sustainability, as two different structures with opposite effects, are parameters that should be considered in all systems. Aircraft engines are structures that negatively affect environmental sustainability with the entropy they produce due to the irreversibility they cause due to fossil fuel consumption. In this study, the effect of different dual zones for constant speed, especially in cruise conditions, was evaluated and their environmental effects due to entropy production were evaluated. In the study, the boundary conditions for different altitude capabilities of the engine, especially in the constant speed condition of 2000 RPM, were discussed. In this respect, using the technical data of the Jet-prop engine taken as a reference, the impact values were calculated over the environmental indices developed. At the end of the study, the effects of entropy production on environmental sustainability and predictions were evaluated.

Keywords: Aircraft, jet-prop, entropy analysis, emission, sustainability.

065
Effect of Phase Change Material on Thermal Behavior of a Lithium-Ion Battery

Uğur Moralı

Eskisehir Osmangazi University, Eskisehir, Turkey

Abstract: This study focuses on the effect of phase change material on lithium-ion battery temperature. The Newman, Tiedemann, Gu, and Kim (NTGK) model was used to predict the maximum battery temperature. The battery was discharged from 0% depth of discharge to 100% depth of discharge at 5C and 290 K. A phase change material was used to restrict the temperature rises. Results showed that the maximum battery temperature was 312.81 K (without PCM) and 308.75 K (with PCM). Average battery temperature was reduced by 1.35% using phase change material. Results also demonstrated the significance of phase change material to the battery temperature distribution. Phase change materials can be used in battery thermal management systems to control battery temperature within safe temperature limits.

Keywords: Thermal management, lithium-ion battery, temperature rise, phase change material, numerical study.

066
A Conceptual Use Case Evaluation of Unmanned Aerial Vehicles in The Structural Inspection of Greenhouses

Elif Koruyucu[1], Emre Özbek[1], Selcuk Ekici[1] and, T. Hikmet Karakoc[1]

[1]*Eskişehir Technical University, Eskişehir, Turkey*

Abstract: The food shortage throughout the world is an important sustainability issue that being addressed by associations and organizations. Drought, the decrease in the workforce in agriculture and the loss of agricultural lands increase the problems in this regard day by day. Therefore, increasing productivity in agriculture is a very important issue. The concept of precision agriculture was born in the light of these needs. There are many areas where unmanned aerial vehicles are used in agriculture: irrigation analysis, soil analysis, spraying, yield forecasting are some of them. In this study, the control of the structural integrity of the greenhouses by flying unmanned aerial vehicles around the structure was investigated. Greenhouses can be affected by natural disasters or winds. As a result, large energy losses can occur, products can be lost, and efficiency loss occurs. In this study, which types of unmanned aerial vehicles can be used for this task, which methods can be used, and previous work examples have been evaluated.

Keywords: Agriculture, UAV, drone, greenhouse, structural inspection.