PROGRAM BOOK

PREFACE

This book is a digital program book detailing presentation schedule and information for the International Symposium on Sustainable Aviation 2020 (ISSA 2020). This book also contains a compilation of abstracts that were virtually presented in the symposium.

Program Book Publication Team
ISSA 2020

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ABOUT UPM

Universiti Putra Malaysia (UPM) is a leading research university in Malaysia, which is also well known as a world renowned centre of learning and research. It was recognized as Universiti Pertanian Malaysia in 1973 with the development and establishment of course in agriculture with three main central faculties and one basic division: the Faculty of Veterinary Medicine and Animal Sciences, Faculty of Forestry, Faculty of Agriculture and a Division of Foundation studies. The last thirty years have seen studies in UPM diverse to include the field of Science and Technology. In 1997, the name Universiti Pertanian Malaysia was changed to Universiti Putra Malaysia, as a strategic gesture to portray the status of UPM as a centre of higher education capable of providing various fields of studies, including medicine and health science, economics and management, engineering, food science and technology, educational studies, design and architecture, computer science and information technology etc. Furthermore, as one of the nation's five leading research universities, UPM is highly committed to the discovery of knowledge, which facilitates national development in the new millennium.

FOREWORD BY VICE CHANCELLOR

Assalamualaikum WBT and a very good day.

Special welcome to the Rector of Eskisehir Technical University, Professor Dr. Tuncay DÖĞEROĞLU, President of Sustainable Aviation and Energy Research Society Professor Hikmet Karakoc, the keynotes speakers, participants, and ISSA committee members.

First of all, I would like to express my sincere gratitude to the Sustainable Aviation and Energy Research Society SARES for the opportunity given to Universiti Putra Malaysia to host the International Symposium for Sustainable Aviation ISSA 2020.

Organising such a prestige international conference is in line to the Universiti Putra Malaysia vision to become a university of international repute. UPM is now gearing towards having more international exposure and activities to ensure good reputation and networking can be established.

I was made to know that the ISSA conference initially planned to be held in the beautiful island of Langkawi at the north of Malaysia on July 2020. However, it has to be shifted to November due to global pandemic COVID-19. It is a bit unfortunate for the intentional delegates not to be able to visit MALAYSIA at this moment, but our doors are always welcome to all of you to visit UPM and Malaysia in the near future

Now, the conference has been realized by having the paper presentation via online platform. Attending conferences is not just a platform to exchange academic and research outcomes, but it is more than that. Whereby, researchers and academics can foster new network and collaboration among them.

I also would like to take this opportunity to congratulate and thanks the Chairman of ISSA 2020, Professor Ir. Ts. Dr. Abd Rahim Abu Talib and the committee members who have worked very hard to ensure the success of the conference.

I hope that all of you will have a fruitful conference and networking.

With that I officiate the International Symposium for Sustainable Aviation 2020.

"With Knowledge We Serve"

PROFESSOR DR. ROSLAN SULAIMAN
Vice Chancellor
Universiti Putra Malaysia

FOREWORD BY DEAN OF FACULTY OF ENGINEERING

Assalamualaikum WBT and greetings.

Special welcome to the Vice Chancellor of Universiti Putra Malaysia, Yang Berbahagia Professor Dr Roslan Sulaiman, Rector of Eskisehir Technical University, Professor Dr. Tuncay DÖĞEROĞLU, President of Sustainable Aviation and Energy Research Society Professor Dr. Hikmet Karakoc, the keynotes speakers, participants, and ISSA committee members.

On behalf of the Faculty of Engineering UPM, I welcome all of you to the International Symposium for Sustainable Aviation ISSA 2020

The International Symposium of Sustainable Aviation conference was founded in 2015 and first held in Istanbul, Turkey. Since then, subsequent ISSA conferences were held yearly in many countries including Kiev-Ukraine, Rome-Italy, Budapest-Hungary, and this year, it is the sixth edition in the series held in Malaysia.

The ISSA 2020 conference is organized by the Department of Aerospace Engineering, Universiti Putra Malaysia and co-organised by the Sustainable Aviation and Energy Research Society (SARES) and Eskisehir Technical University (ESTU). It was initiated to provide a platform for global international aerospace communities to convene and share the recent development and progress in sustainable aviation.

For this edition, ISSA 2020 conference is supported by the National Aerospace Industry Coordinating Agency (NAICO) and the Malaysian Society for Engineering and Technology (MySET).

The ISSA-2020 features keynote presentations by invited speakers and general papers presentations in oral sessions. Due to increasing concerns regarding COVID-19 pandemic, all presentations will be made through an online video conferencing platform. Presenters have to prepare a pre-recorded video for their conference presentation and should be available online for the Q&A session.

It is a great opportunity for the students, academics, researchers and industry players to exchange knowledge and experience through this kind of conference.

I wish you the very best for the conference and networking.

Best wishes,

PROFESSOR IR. TS. DR. NOR KAMARIAH NOORDIN
Dean
Faculty of Engineering
Universiti Putra Malaysia

FOREWORD BY CHAIRMAN

Assalamualaikum WBT and greetings.

Special welcome to the Vice Chancellor of Universiti Putra Malaysia, Professor Dr Roslan Sulaiman, Rector of Eskisehir Technical University, Professor Dr. Tuncay Döğeroğlu, President of Sustainable Aviation and Energy Research Society Professor Hikmet Karakoc, the Dean of Faculty of Engineering, Professor Nor Kamariah Noordin, the keynotes speakers, participants, and ISSA committee members.

The aviation industry is one of the fastest-growing industries in the world. It can be viewed as making a positive contribution to sustainability. The ISSA, an international, multi-disciplinary symposium, aims to address current issues in the field of aviation such as improving aircraft fuel efficiency, fostering the use of biofuels, minimizing environmental impact, mitigating GHG emissions and reduction of engine and airframe noise. As one of the engineering fields with the highest technological density, sustainable aviation is always the spearhead of technological breakthrough. Its continual progression nourishes the other engineering fields and societies. Hence, ISSA 2020 adopts the theme "Affordable and Clean Energy" with the aim of promoting creativity and advancement through the exchange of knowledge and status of cutting-edge research in engineering and technology.

Overall, ISSA 2020 organizer has received over 72 paper submissions from both local and international communities. All accepted papers have undergone an extensive review process by at least two experts from the relevant field. ISSA 2020 is also promoting industry-led research and technology activities among the academia and industry players. ISSA 2020 has attracted researchers and scientists from 16 countries not only from Malaysia but also from Turkey, Taiwan, Saudi Arabia, Russia, India, Netherlands, Taiwan, Ukraine, United Kingdom, Pakistan, Nigeria, Iran, Indonesia, China, Canada and Australia.

High-quality papers of archival value will be considered in extended form for publication in various reputable international journals: Aerospace Science and Technology, Energy, Journal of Aeronautics, Astronautics and Aviation, International Journal of Sustainable Aviation, and Elsevier Book Chapter.

As the Chairman of ISSA 2020, I would like to thank the authors for their contributions and the reviewers for their expertise and valuable comments. We also like to thank the conference organizing committee and UPM for their commitment and tremendous support to the success of ISSA 2020. Our deep gratitude is extended to SARES, ESTU, NAICO and MySET for their cooperation and support for this year's conference

Thank you.

PROFESSOR IR. TS. DR. ABD. RAHIM ABU TALIB
Chairman ISSA 2020

KEYNOTE SPEAKER 1

Professor Hikmet Karakoc
Rector
Eskişehir Technical University

Dr. Karakoc was born in 1959. He graduated from Anadolu University, the Department of Mechanical Engineering, in 1980. He received his M.Sc. degree in Mechanical Engineering from Yildiz Technical University of Istanbul, in 1982. He received his Ph.D. degree from Anadolu University of Eskisehir, in 1987. He started his full-time teaching at Anadolu University. He became an Assistant Professor and an Associate Professor, in 1988 and 1992, respectively. He received his full Professorship in 1997 from Anadolu University in Eskisehir. He has a wide range of research interests, including "Sustainable Aviation, Aircraft Propulsion System, Insulation, Heating Ventilating and Air Conditioning, Indoor Air Quality, Gas Turbines, Cogeneration Systems, Renewable Energy, Energy Economics, Fuels and Combustion". He also served as an Editor-in Chief, and as a guest editor for international scientific journals. He published national and international papers over 300 and 40 books. He is an active member of Chamber of Mechanical Engineers and many sectorial associations, various international scientific organizations and societies.

KEYNOTE SPEAKER 2

Prof. Ts. Shamsul Kamar Abu Samah
Head,
National Aerospace Industry Coordinating Office (NAICO)

Shamsul Kamar graduated from University of Portsmouth, UK in 1998 with a bachelor of engineering degree (Hons) in Electronic and Electrical Engineering. He also holds a Diploma in Electrical Engineering from Universiti Teknologi Malaysia in 1995. He is currently the Head of National Aerospace Industry Coordinating Office, an office under the Ministry of International Trade and Industry. He joined NAICO since 2016 after completing his tenure as the Chief Executive Officer of Aerospace Malaysia Innovation Centre from 2014 till 2016. Previously, he was the Head of Aerospace and Advanced Material at Malaysian Industry-Government Group For High Technology. He also spent over seven years (1999 until 2006) as a Senior Engineer at Sapura Defence Sdn Bhd. Formerly, he served Airod-Alenia Technologies Sdn Bhd as a Radar Maintenance Engineer from year 1995-1996 and 1998-1999. In 2016, Prof. Shamsul was appointed as Honorary Professor by the University of Nottingham Malaysia Campus.

KEYNOTE SPEAKER 3

Professor Dr. Mohamad Nazri Mohamad Jaafar
Faculty of Mechanical Engineering
Universiti Teknologi Malaysia

Mohammad Nazri is a Professor at the School of Mechanical Engineering, Universiti Teknologi Malaysia. He is currently the Head of the Gas Turbine Combustion Research Group. He obtained both his B.Sc in Aeronautical Engineering (1986) and M.Sc in Aerospace Engineering (1989) from Wichita State University, USA. Prof. Nazri obtained his Ph.D. (1997) in the field of combustion from the University of Leeds, UK. He has extensive experience in academic administration as Dean of Transportation Research Alliance, Head of Aeronautical Laboratory, Head of the Department of Aeronautical Engineering, Committee Member of National Aerospace Council, Chairman of UTM's Book Panel, Chief Editor of Jurnal Mekanikal, a member of the advisory committee for aerospace skills development, and team member of the National Accreditation Board (LAN). At the international level, he is a member of the board of editors of the International Journal of Sustainable Aviation.

KEYNOTE SPEAKER 4

Adjunct Professor Ts. Ricky Liew Chee Leong
Head of Engineering (Corporate Jet MRO),
SR Aviation

Ricky Liew is currently the Head of Engineering of SR Aviation Sdn. Bhd. He is an experienced aircraft engineer in aviation industry since 1989. He holds Civil Aviation Authority United Kingdom and Malaysian aircraft maintenance license. A registered engineer with the Board of Engineers Malaysia, he experienced and observed the issues and challenges in aircraft noise reduction technologies and developments. He is a strong proponent of industry academia collaboration to achieve sustainable aviation industry. He is a certified Aerospace and Aviation Professional Technologist at Malaysia Board of Technologist and certified ASEAN Engineering Technologist. He holds an MBA from Victoria University, Australia and an Adjunct Professor of Universiti Putra Malaysia at the Department of Aerospace Engineering. He is also listed as a National Industry Expert (Aerospace) under Ministry of Human Resources, Malaysia. He is a recipient of Sunway Education Star Award 2017 and MBOT Active Technologist Award 2019.

GENERAL PROGRAM SCHEDULE

DAY 1, 9th NOVEMBER 2020, MONDAY	
TIME	**EVENT**
2.00 pm	*Conference Opening* Doa recitation
	Welcoming Speech by ISSA 2020 Chairman: **PROFESSOR IR. TS. DR. ABD. RAHIM ABU TALIB**
	Welcoming Speech by President SARES: **PROFESSOR HIKMET KARAKOC**
	Welcoming Speech by Dean Faculty of Engineering: **PROFESSOR. DR. NOR KAMARIAH NORDIN**
	Welcoming Speech by Rector ESTU: **PROFESSOR. DR. TUNCAY DÖĞEROĞLU**
	Opening Remarks and Officiate by Vice Chancellor of UPM: **PROFESSOR DR. ROSLAN SULAIMAN**
	Video presentation
3.00 pm	*Keynote Address I* ***Professor Hikmet Karakoc*** *President SARES* Indoor Air Quality (IAQ) in Aircraft and Possible Problems Related with IAQ
4.00 pm	*Keynote Address II* ***Professor Dr. Mohammad Nazri Mohammad Jaafar*** *Universiti Teknologi Malaysia, Malaysia* Sustainable Aviation Fuel for the Future: Biokerosene Case Study using Coconut Oil
5.00 pm	End

DAY 2, 10th NOVEMBER 2020, TUESDAY	
TIME	**EVENT**
9.00 am	*Keynote Address III* ***Professor Ts. Shamsul Kamar Abu Samah*** *National Aerospace Industry Coordinating Office (NAICO), Malaysia* Advancing Malaysia's Sustainable Aviation
10.00 am	*Keynote Address IV* ***Adjunct Professor Ts. Ricky Liew Chee Leong*** *SR Aviation, Malaysia* The Legal Requirements, Challenges and Issues of Aircraft Noise Reduction
11.00 am	*Technical session A1* (ID008) *Aerodynamic Force of Coandà Jet on a Curved Surface with Slanted Profile* **Muhammad Alimin Shafie (Universiti Putra Malaysia)** (ID018) *Numerical Analysis of Leading Edge Cylinder Aerofoil on Selig S1223 for Moving Surface Boundary Control* **Azmin Shakrine Mohd Rafie (Universiti Putra Malaysia)** (ID037) *Analysis of De Laval Rocket Engine Nozzle using Computational Fluid Dynamics* **Md Amzari Md Zhahir (Universiti Putra Malaysia)** (ID043) *Feasibility Study for Exploiting Aerodynamic Drag in Very Low Earth Orbit with Different Flat Plate Configurations* **Syafiq Raihan (Universiti Putra Malaysia)** (ID044) *Computational Aerodynamic Analysis of UiTM's Hawkeye UAV Aircraft* **Zurriati Mohd Ali (Universiti Teknologi MARA)** *Technical session B1* (ID048) *Validation of Low Fidelity Propeller-wing Modeling Method at Low Reynolds Number* **Baizura Bohari (National Defence University of Malaysia)**

	(ID050) *The Effect of Streamwise Location of Micro Vortex Generator on Airfoil Aerodynamic Performance in Subsonic Flow* **Mohd Rashdan Saad (National Defence University of Malaysia)** (ID053) *CFD Analysis of Beta-type Stirling Engine by using Fins as Regenerator* **Thavamalar Kumaravelu (Universiti Putra Malaysia)** (ID055) *Validation and Verification of Aerodynamics Loading of Schrenk Approximation, Prandtl Lifting-line and Computational Fluid Dynamics with Experiment on a NACA Series* **Adi Azriff Basri (Universiti Putra Malaysia)** (ID046) *Aerodynamics Performance of Selig Airfoil Thickness using Computational Fluid Dynamics* **Adi Azriff Basri (Universiti Putra Malaysia)**
2.00 pm	<u>*Technical session A2*</u> (ID065) *Numerical Analysis of Tesla Bladeless Micro-turbine Performance on the Individual Pitot Tube Inlet* **Adi Azriff Basri (Universiti Putra Malaysia)** (ID066) *Development of Tailored Product Life-cycle (PLC) for Small Sounding Rocket Development* **Azmin Shakrine Mohd Rafie (Universiti Putra Malaysia)** (ID025) *Conceptual Design of Piezoelectric Based Energy Harvesting Seats for Commercial Aircraft* **Erfan Salami (University of Malaya)** (ID024) *Effect of the Erosion on the Performance of a Transonic Compressor Rotor* **Nizar A. Qattan (King Abdelaziz University)** (ID058) *Design and Integration of Large Lithium Based Battery Packs for Electric Vehicles* **Isil Yazar (Eskisehir Osmangazi University)**

Technical session B2

(ID031)
Aeronautical Ground Lighting (AGL) Effectiveness in Kuala Lumpur International Airport (KLIA): A Review
Hamdan Ahmad (Universiti Tun Hussein Onn Malaysia)

(ID004)
Analysis and Visualisation of KLIA Departure Delay Flight Pattern
Siti Mariam Abdul Rahman (Universiti Teknologi MARA)

(ID045)
Collaborative Allocation of Slot for Arrival Flights in Multi-Airport Terminal Area Based on the Traffic Flow Pattern ：A Case Study of Shanghai Terminal, China
Lina Ma (Nanjing University of Aeronautics and Astronautics)

(ID039)
Exploratory Study on Deployability of Distress Call Bird Repellent System at Walton Aerodrome, Pakistan (A Methodological Approach)
Abdul Moeez (University of Management and Technology Lahore)

(ID032)
Anti-/de-Icing Fluid Quality Management as an Object to Provide Safe Aircraft Takeoff
Boris Safoklov (Moscow Aviation Institute)

4.00 pm

Technical session A3

(ID049)
Systems Engineering from Islamic Perspective
Ahmad Alsudairi (Universiti Putra Malaysia)

(ID002)
Behaviour of Different Silica Aerogel with Aluminium Alloy Composite in High-Temperature Application
Ibrahim Mohammed (Air Force Institute of Technology Nigeria)

(ID030)
Cabin Air Quality Enhancement System with High Pressure Water Separator
Amir Shahneh (Cranfield University)

(ID001)
The Need of English Language Proficiency for Aviation Maintenance Personnel in Malaysia
Fairuz Romli (Universiti Putra Malaysia)

(ID072)
Evaluation of Quadrotor Flight And Battery Consumption During Turbulence Using Open-jet Wind Tunnel
Elya M.N. (National Defence University of Malaysia)

Technical session B3

(ID020)
Analysis of the Environmental Situation in the Airport Impact Area via the Method of Directed Sign Graph (Digraph)
Inokentii Horobtsov (National Aviation University, Ukraine)

(ID014)
Investigation of Carbon and Technology Management Considering Exergy Approach in Airport
M. Ziya Sogut (Piri Reis University)

(ID062)
Surface Roughness Optimization Investigation of Al6082 Aviation Aluminum Alloy
Ömer Secgin (Sakarya University of Applied Sciences)

(ID041)
CO_2 Emissions Reduction Thru Creating a More Sustainable Airline's Network Operation for Europe
Daniel Van Der Mee Mendes (Amsterdam University of Applied Sciences)

(ID027)
Substituting Short-Haul Flights by Rail Transport to Reduce CO2 Emission in Europe
Tim Koper (Amsterdam University of Applied Sciences)

6.00 pm	End

DAY 3, 11th NOVEMBER 2020, WEDNESDAY	
TIME	**EVENT**
9.00 am	*Technical session A4* (ID052) *Implementation of a Five-hole Probe for Investigating the Flow Field Behind a Permeable Hemispherical Parachute* **Fakhri Etemadi (McGill University)** (ID034) *The Effect of Inboard and Outboard Wing Sweep Angles to Lift-to-Drag Ratio of a Compound Wing-Body using Panel Code* **Rizal E. M. Nasir (Universiti Teknologi MARA)** (ID064) *Multi-Rotor Unmanned Aerial Vehicle (UAV) Aerodynamic Perspective of Different Propeller Blade Design: A Review* **Ahmad Fariduddin Ahmad Faris (Universiti Putra Malaysia)** (ID069) *Dimensional Analysis on the Aerodynamic Performance of Coanda Airfoil Design* **Mohd Faisal Hamid (Universiti Putra Malaysia)** (ID056) *Computational Fluid Dynamics Modelling of Hybrid Rocket Flow-Fields* **Muhammad Hanafi (International Islamic University of Malaysia)** *Technical session B4* (ID068) *Performance and Exhaust Emissions Rate of Small-scale Turbojet Engine Running on Dual Biodiesel Blends and Single Biodiesel Blends using Gasturb* **Yazan Altarazi (Newcastle University)** (ID010) *Numerical Analysis of Chamber Configuration for Hydrogen Peroxide Monopropellant Thruster* **Muhammad Shahrul Nizam Shahrin (Universiti Teknologi Malaysia)**

	(ID022) *Numerical Modeling of Dynamic Behavior of a Double-Acting Four-Cylinder Stirling Engine* **Tan Yi Han (National Cheng Kung University)** (ID022) *Design and Theoretical Analysis of a Vuilleumier Refrigerator* **Jhen-Syuan Huang (National Cheng Kung University)** (ID051) *Internal Flow Dynamics and Performance of Pulse Detonation Engine With Alternative Fuels* **Mahammadsalman Warimani (International Islamic University Malaysia)**
11.00 am	<u>*Technical session A5*</u> (ID026) *Control and Simulation of Obstacle Avoidance for a Quadcopter* **Mastura Ab Wahid (Universiti Teknologi Malaysia)** (ID035) *Black-Box Identification and Attitude Control of a Battery Powered, Unmanned, Finless Airship* **Fazri Sedan (Universiti Putra Malaysia)** (ID036) *Flight Dynamic Stability Performance of the Baseline-IX Blended-Wing-Body Unmanned Aerial System using Flight Simulator* **Shahrean Zainurin (Universiti Teknologi MARA)** (ID047) *Dynamic Behaviour Comparison of Quadcopter Based on Thrust Differential and Tilted Rotor* **Mohd Razip Abdullah (Standard and Industrial Research Institute of Malaysia)** (ID054) *Fighter Aircraft Closed Loop Handling Quality Simulation on Lateral-directional Modes* **Hindawan Hariowibowo (Institut Teknologi Bandung)**

	Technical session B5 (ID038) *A Study of 3D-Printed Box Structure* **Atikah Basyirah Abdul Mutaali (Universiti Teknologi MARA)** (ID057) *Comparative Studies on the Effect of Amine/Hardener (r) Ratio on the Mechanical and Thermal Properties of Epoxy Resin* **Dayang Laila Majid (Universiti Putra Malaysia)** (ID059) *Damage Assessment on Numerical Modelling of Rotating Engine Blades Subjected to Bird Strike* **Nur Azam Abdullah (International Islamic University of Malaysia)** (ID067) *Computational Study of Mass Reduction of a Conceptual Microsatellite Structural Subassembly Utilizing Metal Perforations* **Mohammad Yazdi Harmin (Universiti Putra Malaysia)**
2.00 pm	*Technical session A6* (ID017) *Designing of Battery Management System for Lithium Based Battery Packs Using at Electric Aircraft* **Burak Tarhan (Eskisehir Technical University)** (ID023) *Failure Modes and Effects Analysis of T-56 Turboprop Engine Turbine* **Nizar A. Qattan (King Abdelaziz University)** (ID005) *Reliability Analysis of C-130 Turboprop Engine Turbine* **Nizar A. Qattan (King Abdelaziz University)** (ID060) *Investigation of Thermodynamics Performance of Jet Engine in Flight Elevation* **Mehmet Ziya (Piri Reis University)** (ID061) *Investigation of Entropy Optimization Related to Thrust Control for Jet Engine in Atmospheric Elevation* **Mehmet Ziya (Piri Reis University)**

	Technical session B6 (ID042) *Method for Increasing Stability and Controllability when Moving on the Ground of an Unmanned Aerial Vehicle of an Aerodynamic Scheme of a Flying Wing* **Boris Safoklov (Moscow Aviation Institute)** (ID033) *Airdrop of Discharged Batteries Using an Unmanned Aerial Vehicle as a Method of Increasing the Range of an Electric Aircraft by Reducing the Mass in Flight* **Boris Safoklov (Moscow Aviation Institute)** (ID070) *Multiobjective Optimisation of Civil Tiltrotor Powerplants Incorporating Reheat* **Ezanee Gires (Universiti Putra Malaysia)** (ID040) *Mission Analysis of 90 Pax Hybrid Aircraft for Sustainable Aviation* **Devendra Singh (CSIR-NAL Benguluru India)** (ID063) *Conceptual Design and Mission Analysis of Hybrid-electric Short-haul Amphibian Aircraft for Sustainable Aviation* **Rajkumar S. Pant (Indian Institute of Technology Bombay)**
4.00 pm	*Closing Ceremony* Doa recitation
	Welcoming Speech by ISSA 2020 Chairman: **PROFESSOR IR. TS. DR. ABD. RAHIM ABU TALIB**
	Welcoming Speech by President SARES: **PROFESSOR HIKMET KARAKOC**
	Award Presentation
5.00 pm	Conference End

ABSTRACTS

ID001

THE NEED OF ENGLISH LANGUAGE PROFICIENCY FOR AVIATION MAINTENANCE PERSONNEL IN MALAYSIA

Suhailah Ahmad Shukri, Fairuz I. Romli, Aina Suriani Mahmood, Wan Teh Fatimah Wan Badaruddin

Abstract: The Civil Aviation Authority Malaysia has emphasized all candidates who are pursuing Aircraft Maintenance License to have a minimum credit of English language. Meanwhile, upon being granted the license, they must already have an English language competency of ICAO Level 4 (Operation). This is actually an extra requirement imposed by the Civil Aviation Authority Malaysia for local aviation maintenance personnel in Malaysia since English is not the first language for the majority of them. In regards to this situation, this study aims to establish the need for English language proficiency among the aviation maintenance personnel in Malaysia to effectively execute their tasks through a conducted survey. A total of 22 respondents from local aviation maintenance companies have participated in the survey. Based on the analysis results of the collected survey responses, it is concluded that many aviation maintenance tasks often involve a high use of English language and the maintenance personnel must possess good English language proficiency to ensure the correct and smooth execution of the tasks. This finding greatly supports the action of Civil Aviation Authority Malaysia to enforce the additional English language competency requirement for local maintenance personnel in Malaysia as part of their efforts to reduce the numbers of aircraft accidents and incidences caused by the maintenance errors that arise from misinterpretation and also misunderstanding of the technical documents and verbal instructions.

Panel: General

ID002

BEHAVIOUR OF DIFFERENT SILICA AEROGEL WITH ALUMINIUM ALLOY COMPOSITE IN HIGH-TEMPERATURE APPLICATION

Ibrahim Mohammed, Abd Rahim Abu Talib

Abstract: The study was based on the behavior of composite of aluminium alloy 2024-T3 coated with thin layer of aerogel/epoxy and that coated with epoxy/different types of silica aerogel subjected to flame fire using a standard ISO2685 propane-air burner. The main objective of this study is to develop a new, user friendly composite and to evaluate the behaviour of the composites by determining the burn-through time responses of different silica aerogel used. The composites were developed to resist a flame fire of 1100 ± 80ºC temperature and 116 ± 10 kW/m2 heat flux for at least 15 minutes for fireproof and 5 minutes for fire resistance composite. The composites were fabricated using one weight percent of silica aerogel in an epoxy resin/hardener and were mixed using mechanical mixer and sonicator. The results indicate that composite of GEATM 0.125 silica aerogel resists higher flame than the other types of aerogel composites examined, where it was 5.56% and 10.39% more fire resistance than Enova® IC3100 and Hamzel® respectively. The study reveals that aluminium alloy 2024-T3 coated with silica aerogel possess good properties to resist high temperature in fire designated zones of an aircraft engine.

Panel: Structures and Materials

ID004

AIRSPACE CAPACITY VS. AIRPORT CAPACITY: CAN OUR AIRSPACE ACCOMMODATE MORE TRAFFIC GROWTH?

Mohd Taufiq Bin Zainal Abidin, Siti Mariam Binti Abdul Rahman

Abstract: The number of passengers on Kuala Lumpur International Airport (KLIA) and on KLIA Terminal Control Area (TMA) had been steadily increasing over the year. It is forecasted that by 2020, KLIA and KLIA2 will reach a number of 78 million passengers per annum, which has already exceeded its capacity of 75 million passengers. The aim of the study is to find a correlation between flight departure delay and air occupancy, as well as ground parameters of the departure. To achieve this, regression and correlation analysis were conducted on the traffic delay, air occupancy, and runway departure and runway occupancy time. The data were acquired using Automatic Dependent Surveillance Broadcast (ADS-B) at range from 1/2/2019 to 28/2/2019. Based on the analysis, it was gathered that the mean daily flight departure delay has a moderate positive relationship with TMA air occupancy with a correlation of 0.5604. It can also be concluded that different combinations of the route used for the flight to depart, from its taxying points to the departure runway affects the delay of the departure. However, other parameters such as runway occupancy time and distance to the runway have a weak correlation (r lower than 0.5) towards departure delay.

Panel: Airport & Operations

ID005

RELIABILITY ANALYSIS OF C-130 TURBOPROP ENGINE TURBINE

Nizar Awadallah Qattan, Belkacem Kada, Ali M Al-Bahi

Abstract: In this paper, local operational data were used for failure prediction and validation of Lockheed T-56 Engine turbine operating GCC desert environment. the results exhibit wears out failure patterns, which can be used by local operators to assess and customize maintenance programs based in the regional environment. For this purpose, turbine time to failure is predicted using Two parameters Weibull distribution model and tested by Lognormal distribution model.

Panel: Propulsion & Power

ID008

AERODYNAMIC FORCE OF COANDÀ JET ON A CURVED SURFACE WITH SLANTED PROFILE

Muhammad Alimin Shafie, Mohd Faisal Hamid, Azmin Shakrine Rafie

Abstract: Aircraft with the ability of vertical take-off and cruise at higher speeds are of greater interest when considering the future of air mobility, especially considering the cost and space available in urban areas; Coandà effect-based aircraft is one of the best candidates. However, the present knowledge on this technology is not fully explored, such as the profile of the curved surface in an effort to harness the utmost augmented lift force. This paper presents an experimental evaluation on the aerodynamic forces due to the changes in the curved surface slanting profile angle subjected by the Coandà jet flow. The test model is an axisymmetric 2D half-hemispherical curved shape, with a series of semi-circular and semi-elliptic curved surface geometries. The lift distributions produced due to the Coandà effect is obtained by measuring the static pressure from a series of pressure tapping points located along the curved surface, which are connected to a mutimanometer. The static pressure distributions are plotted and analyzed to obtain the amount of lift force generated. The result has shown that by altering the slanting angle of the curved surface has yielded additional lift, up to 13%; due to the translation of the concentrated pressure region on the curved surface. Modifying the geometrical Coandà curved surfaces profile promotes higher lift output than the existing Coandà jet design surface geometry.

Panel: Aerodynamics

ID010

NUMERICAL ANALYSIS OF CHAMBER CONFIGURATION FOR HYDROGEN PEROXIDE MONOPROPELLANT THRUSTER

Muhammad Shahrul Nizam Shahrin, Norazila Othman, Nik Ahmad Ridhwan Nik Mohd, Mastura Abd Wahid

Abstract: Numerical analysis could help in developing an optimized design of the green propulsion thruster system with competitive costs compare to optimization process through series of tests, since experiments are very costly in term of economy and time. Furthermore, numerical analysis could be used to predict engine performance as well as providing information of the combustion process that can be used to identify the cause of experimental phenomenon. As the concern on environment grows, hydrogen peroxide arises as an option to the thruster propulsion system replacing hydrazine-based propellant which are toxic and carcinogenic. A series of experiments have been conducted throughout the world but a study on hydrogen peroxide monopropellant thruster need a specific attention. The work presented in this paper was performed to simulate the fluid flow of hydrogen peroxide monopropellant thruster. A 50 Newton thruster is modelled to utilized high grade hydrogen peroxide (90 wt%) as propellant and to study the effect of injection diameter, and effect of chamber diameter to the flow field inside thruster. Two-dimensional numerical models of the catalytic decomposition in the thruster configurations have been developed with injection diameter of 1.3mm and chamber diameter of 17mm. The flow is modelled as single-phase, the catalyst was modelled as porous medium, and operates at atmospheric pressure of 1 atm and 300K inlet temperature, while k-ω turbulence model was used. A pressure and temperature distributions are generated from this simulation. Numerical analysis helped in understanding the effects of chamber configurations to the flow fields inside the thruster.

Panel: Propulsion & Power

ID014

INVESTIGATION OF CARBON AND TECHNOLOGY MANAGEMENT CONSIDERING EXERGY APPROACH IN AIRPORT

Mehmet Söğüt

Abstract: Sectoral pressures created by the awareness of global warming and climate change have made the control of emission emissions important in the aviation industry. This study expresses a framework for improving the manageability of fossil emissions directly at airports. In addition to airborne pollution at airports, it should be taken under control in emissions from fossil fuels caused by transportation and building stock. In this context, sustainability of technology and carbon management should be taken as basis in airports. Depending on the scenarios created in the study, the holistic approach of energy use together with technology management for an airport was evaluated. Exergy approach is an important tool used to describe the effect of inefficiency in process analysis. In this context, example efficiencies that will be provided by using low carbon technologies in airports were also presented.

Panel: Airport & Operations

ID017

DESIGNING OF BATTERY MANAGEMENT SYSTEM FOR LITHIUM BASED BATTERY PACKS USING AT ELECTRIC AIRCRAFT

Burak Tarhan, Ozge Yetik, Tahir Hikmet Karakoc

Abstract: Energy and environmental issues have long been challenges facing the aviation industry. In recent years, the grim energy and environmental situation around the world has accelerated the strategic transformation of transportation and energy technology, and thus set off a worldwide upsurge of new energy vehicle development. This new energy vehicle is Lithium based battery.

However, Lithium battery technology alone isn't sufficient for the automotive and aviation sector. Because, the battery pack voltage, temperature, current, DC resistance, polarization voltage SOC, SOH values should be known when using the lithium batteries. It should also include alarm and shutdown system for avoid abuse and irrational use to ensure safety. In addition, real-time monitoring provides a great advantage for controlling battery status during the battery usage in the electric aircraft.

In line with these aims, Battery management system (BMS) for electric aircraft has been designed. While the design was being carried out, support has been received from the battery management system (BMS) design applied for electric vehicles (EV).

Panel: Propulsion & Power

ID018

NUMERICAL ANALYSIS OF LEADING EDGE CYLINDER AEROFOIL ON SELIG S1223 FOR MOVING SURFACE BOUNDARY CONTROL

Hidayatullah Mohammad Ali, Azmin Shakrine Mohd Rafie, Syaril Azrad Md Ali

Abstract: The Leading Edge Cylinder Aerofoil has resulted in an outpour of research studies for almost a century till date but fewer attempt has focused on the embedment of a cylinder with undercambered aerofoil. This research was aimed to ascertain whether the concept could enhance the intended aerofoil's aerodynamic properties. The performance of the model was tested using computational fluid dynamic code ANSYS Workbench 2019 to simulate two-dimensional flow analysis with a variant of rotational speed up to 2000 RPM for different free stream speeds ranging from 5 to 30 m/s at various angles of attacks with the Reynold number ranged from 4.56E+05 to 2.74E+06. Indeed, mesh independency test has validated for both the cylinder and the Selig S1223 aerofoil from past researchers' data prior to designing the best model embedment. The analysis resulted in an enhancement in the lift coefficient and stall angle delay of about 23% and 61%, respectively.

Panel: Aerodynamics

ID020

ANALYSIS OF THE ENVIRONMENTAL SITUATION IN THE AIRPORT IMPACT AREA VIA THE METHOD OF DIRECTED SIGN GRAPH (DIGRAPH)

Inokentii Horobtsov, Larysa Cherniak, Margaryta Radomska

Abstract: Airports are massive and state important enterprises yet underrepresented in studies on environmental impacts of aviation. Most research works in this field are limited to focus on few most prominent impacts (air, noise, climate) or consideration of individual airports not claiming versatility, even though ever more people today are hoping that addressing environmental challenges of aviation will cause major changes globally. However, aviation industry as well as its structural elements is extremely complex systems with many variables and interconnections. Thus, it is important to (a) analyze these internal elements' relationships within systems, and the consequences their changes produce for each other and for the whole system, (b) rank the wide spectrum of airports induced environmental problems to prioritize their solution correctly, and (c) construct an appropriate descriptive model. For these purposes, we suggest using methodology of directed graph (cognitive map) via variables identification and rating based on expert opinion assessment.

Panel: Airport & Operations

ID022

NUMERICAL MODELING OF DYNAMIC BEHAVIOR OF A DOUBLE-ACTING FOUR-CYLINDER STIRLING ENGINE

Chin-Hsiang Cheng, Hang-Suin Yang, Yi Han Tan, Jun-Hong Li

Abstract: The study focuses on the dynamic simulation of the four-cylinder double-acting α-type Stirling engine with wobble-yoke mechanism using the non-ideal adiabatic thermodynamic model, kinematic model and dynamic model. The thermodynamic model calculates the mass, temperature and pressure of each engine's chamber. The pressure values are taken as force inputs for the kinematic and dynamic model to predict the four pistons' displacements. Based on the dynamic model, the displacements, velocities, accelerations, angular velocities and angular accelerations of the linking mechanisms can be obtained. The simulation is carried out until the engine reaches the stable operating regime. Under the charged mass of 1.178×10-3 kg, equivalent to charged pressure of 10 bar, under the loading torque of 14 N•m, at heating temperature of 900 K, the shaft power is 484 W, and the total efficiency is 10% at 332 rpm.

Panel: Propulsion & Power

ID023

FAILURE MODES AND EFFECTS ANALYSIS OF T-56 TURBOPROP ENGINE TURBINE

Nizar Qattan, Belkacem Kada, Ali M Al-Bahi

Abstract: FMEA was used to analyze the failure modes, causes, and effects of the T-56 engine turbine. Failure location and contributing factors were identified and categorized. To give an insight into risk assessment and priority for corrective action, FMEA data were ranked using RPN ranking. From the FMEA matrix, the major failure mode of the T-56 engine turbine was found to be the mechanical damage due to structural failure caused by different factors like erosion and sand ingestion. On the other hand, field data capture the operational and environmental stresses associated with the actual usage conditions and allows for more accurate predictions of the reliability performance of the components. This enables the operators to develop appropriate inspection or replacement programs, and spare part plans based on their own operational and environmental conditions, which result in decreasing maintenance costs and minimizing flight delays and cancellations due to unexpected failures.

Panel: Propulsion & Power

ID024

EFFECT OF THE EROSION ON THE PERFORMANCE OF A TRANSONIC COMPRESSOR ROTOR

Nizar Qattan, Belkacem Kada, Ali M Al-Bahi

Abstract: Air sand erosion is a widely effecting phenomenon in the GCC region, where a solid particle impacting on a wall surface causing catastrophic mechanical damage, the engine compressor operating in a particulate environment are subjected to deterioration of performance and life due to sand ingestion. In the current paper, a numerical study is performed to predict the erosion rate of the rotor 37 under the effect of different factors such as flow rate of air, particle mass concentration and size of the particles of the solid. Transport equation for continuity and momentum in steady form for two phases Solid (sand) and fluid (air) are solved via the Eulerian approach. The result shows that the average values of the erosion rate density increase significantly with the increase in the value of the particle flow rate, where particle size has less effect among all other measured parameters. On the other side, the overall performance of the compressor in terms of pressure ratio decreases with the increase in the values of both particle size and particle's mass flow rate corresponding to the same values of the airflow rate. Surface deformation and roughness are in scope for further investigation.

Panel: Propulsion & Power

ID026

CONTROL AND SIMULATION OF OBSTACLE AVOIDANCE FOR A QUADCOPTER

Mastura Ab Wahid, Norazila Othman, Mohd Zarhamdy Md Zain, Nik Mohd Ridzuan Shaharuddin

Abstract: The demand for Unmanned Aerial System (UAS) in today's world is increasing to improve the safety, well-being and sustainability of our community. However, there are still issues to be solved, and one of the issues discussed in this paper is the avoidance issue where the UAS is designed to manoeuvre in rural areas. This study presents a conceptual of the control method and motion used to avoid the obstacle using a PID controller and a laser scanner applied to a quadcopter. The measurement on distance error and the standard deviation is conducted on the laser scanner to be implemented in the avoidance controller where it will be simulated in Matlab Simulink. It was found that the error decreases with distance and expected distance error is about 4mm with a standard deviation of 0.1577mm. The PID controller designed can follow a defined path with no overshoot error in horizontal position and a 5% error in altitude. In addition, the decision and trajectory path for the quadcopter to avoid the obstacle is constructed, and the result shows that the algorithm can avoid obstacle with a minimum clearance of 0.5m to avoid damage on the quadcopter.

Panel: Guidance & Control

ID027

SUBSTITUTING SHORT-HAUL FLIGHTS BY RAIL TRANSPORT TO REDUCE CO2 EMISSION IN EUROPE

Tim Koper

Abstract: The aviation industry continues to grow rapidly. Since the beginning of this century air traffic has doubled thereby increasing its carbon footprint significantly. To respond to the greenhouse-gas-emissions mitigation of the Paris agreement the aviation industry could find short-term solution in high-speed rail as this is currently the main competitor to airlines. This study aims to create a model which can identify routes within an existing network that have the capability to replace short-haul flights with high-speed rail. As an example, this model is applied to the European short-haul network of KLM departing from Amsterdam Schiphol Airport. The model consists of an analysis based on four criteria which are: route accessibility, journey time, sustainability, and substitution availability. Results show that it could reduce the carbon emission of KLM's short-haul network by 62%.

Panel: Airport & Operations

ID028

DESIGN AND THEORETICAL ANALYSIS OF A VUILLEUMIER REFRIGERATOR

Chin-Hsiang Cheng, Jian-Hua Feng, Jhen-Syuan Huang

Abstract: In this study, a Vuilleumier refrigerator is analyzed with thermodynamic modeling. Periodic variations in volume, mass, pressure and temperature in different chambers of the cylinder are predicted. The effect of clearance leakage and buffer chamber on the working space are considered. A prototype of the Vuilleumier refrigerator is manufactured, and the influence of each operating parameter on the cold head temperature in theoretical model is discussed and compared with experiment results. The operating parameters include charged pressure, rotating speed, heating temperature and cooling temperature. The refrigerator can reach 254 K cold head temperature at the operating conditions of 14 bar charged pressure, 600 rpm rotating speed, 900 K heating temperature, and 300 K cooling temperature for experiment.

Panel: Propulsion & Power

ID030

CABIN AIR QUALITY ENHANCEMENT SYSTEM WITH HIGH PRESSURE WATER SEPARATOR

Amir Shahneh

Abstract: The Electrical Environmental Control System (EECS) uses separate compressor and electric motor for compressed air instead of air extracting bleed air from engine. For a civilian aircraft carrying 200 passengers with temperature of 220C, Relative Humidity (RH) of 15-18% and cruise altitude of 35,000 feet, the EECS is equipped with two independently electronically controlled three-wheel bootstrap Air Cooling Machine packs with high pressure water separator which are capable of supplying enough amount of fresh ventilation air of 1.3 kg/s as per the design requirements. Cabin pressurisation systems are incorporated to maintain average cabin altitude of 5500 and not more than 7000 ft. Air from the atmosphere is drawn by compressor operated by electronically controlled electrical motor. Before the air entering the main compressor, an inertial high pressure water separator is provided to separate the water or excess moisture. Water separator is by-passed once the aircraft attains higher altitude to avoid complete removal of moisture from air. The process promises a higher air quality for passengers and crew.

Panel: General

ID031

AERONAUTICAL GROUND LIGHTING (AGL) EFFECTIVENESS IN KUALA LUMPUR INTERNATIONAL AIRPORT (KLIA): A REVIEW

Mohd Syafiq Aidil Law, Hamdan Ahmad, Nurhayati Rosly, Mohamed Thariq Hameed Sultan

Abstract: Aeronautical Ground Lighting (AGL) or Taxiway lighting is defined as any type of ground lighting intended to provide air navigation guidance to pilots. It consists of General Airport Lighting, Approach Lighting, Runway Lighting, and Taxiway Lighting. The AGL's intensity is controlled by Air Traffic Controllers (ATC) and maintained by Aerodrome Operator. Portions of the lighting system are reported in low effectiveness hence causing unfamiliar pilots to confuse during taxi during poor visibility condition, and in worst case resulting in taxiway incursion. Therefore, this paper reviews the AGL effectiveness in KL International Airport (KLIA) and the sustainability elements in it as it is the main gateway and also the largest international airport in Malaysia.

Panel: Airport & Operations

ID032

ANTI-/DE - ICING FLUID QUALITY MANAGEMENT AS AN OBJECT TO PROVIDE SAFE AIRCRAFT TAKEOFF

Boris Safoklov, Oleg Dolgov

Abstract: This paper discusses the possibility of the evolution of quality control of an object of ground anti-icing physicochemical treatment of the surface of an aircraft - anti-icing fluids, in "Quality management anti-icing fluid as an ensuring object for the safe takeoff of an aircraft." The definition - "The quality of the anti-icing fluid" has been formulated. As a functional, it was introduced the concept of "Quality of anti-icing fluid at the stage of anti-icing treatment of an aircraft". For the implementation of information software support for the anti-icing treatment process, the concept of "Regeloscopic program of ground anti-icing protection of aircraft" was introduced, on the basis of which a functional model was presented for the building a strategy for processing and protection of aircraft from ground-based icing in accordance with modern requirements for aviation industry.

Panel: Airport & Operations

ID033

AIRDROP OF DISCHARGED BATTERIES USING AN UNMANNED AERIAL VEHICLE AS A METHOD OF INCREASING THE RANGE OF AN ELECTRIC AIRCRAFT BY REDUCING THE MASS IN FLIGHT

Boris Safoklov, Oleg Dolgov, Sergey Aruvelli

Abstract: Over the past few years, a large number of developments devoted to electric motors and electric aircraft. However, electric aircraft have some limitations and disadvantages. One of which is the invariability of the mass of the aircraft during the flight, which reduces the possible aircraft range. In this paper, was developed a method of increasing the electric aircraft range by airdrop batteries placed in containers that are designed as an unmanned aerial vehicle aerodynamic scheme-flying wing.

Panel: Design & Performance

ID034

THE EFFECT OF INBOARD AND OUTBOARD WING SWEEP ANGLES TO LIFT-TO-DRAG RATIO OF A COMPOUND WING-BODY USING PANEL CODE

Rizal E. M. Nasir, Nabil F. Tajuddin, Atikah B. A. Muta'Ali, Wahyu Kuntjoro, Fairuz I. Romli, Wirachman Wisnoe

Abstract: Compound wing consists of inboard and outboard wings and it is essential to look at these sweep angles' impact to aerodynamic performance. In this paper, the effect of inboard and outboard wing leading-edge sweep angle to lift-to-drag ratio of compound wing-body aircraft is investigated. The method of investigating aerodynamics is via computation using Panel Code in OpenVSP software combine with calculation of parasite drag coefficient based on Blasius' friction coefficient equations and Torenbeek's form factor. Baseline-IX BWB becomes the base design of this study where there are a total of ten inboard and outboard sweep angle cases. Comparison between panel code computation and wind tunnel experiment results shows similar trend and magnitude up to 12.0 deg. angle of attack. The trend of all cases is similar to the original case where maximum L/Ds for almost all cases also occur at = +6.0 deg. The cases where Li = 30 deg. have the highest lift-to-drag ratio, followed by Li = 45 deg. and the lowest are for Li = 15 deg. For outboard wing sweep cases, no conclusive trend can be concluded.

Panel: Aerodynamics

ID035

BLACK-BOX IDENTIFICATION AND ATTITUDE CONTROL OF A BATTERY POWERED, UNMANNED, FINLESS AIRSHIP

Mohd Fazri Sedan, Ahmad Salahuddin Mohd Harithuddin

Abstract: The paper presents the system identification of a battery powered, finless airship. The mathematical model of the airship is developed based on black-box system identification modeling methodology, where the attitude dynamic of the airship is determined by using the relation between input and output data collected from a series of outdoor flight tests. The estimated model then validated with a data collected from validation flight test. A PID controller for attitude control of HAU developed based on this estimated model. The PID controller then simulated in Simulink with the estimated model and implemented in the HAU controller for evaluation via outdoor flight test.

Panel: Guidance & Control

ID036

FLIGHT DYNAMIC STABILITY PERFORMANCE OF THE BASELINE-IX BLENDED-WING-BODY UNMANNED AERIAL SYSTEM USING FLIGHT SIMULATOR

Shahrean Zainurin, Rizal Effendy Mohd Nasir, Wahyu Kuntjoro

Abstract: A flight simulator or software-in-the-loop system (SITL) could be used to gather the flight quality or performance data of an unmanned aerial system (UAS) virtually. The concept was done by integrating the ground control system (GCS) software and an advance flight simulation software. For the purpose of this research, Mission Planner was used as the GCS and X-Plane 11 as the flight simulation software. Unlike the ordinary or conventional aircraft, a BWB UAS flying quality characteristic is known to be unstable. Through the SITL concept, every new design blended-wing-body (BWB) UAS flying quality could be tested virtually in a realistic environment through the realism of a flight simulator. The BWB UAS will be tested under various environment model and a set of flight performance data were produced. The data were used to understand the flight characteristic of the design under test.

Panel: Guidance & Control

ID037

ANALYSIS OF DE LAVAL ROCKET ENGINE NOZZLE USING COMPUTATIONAL FLUID DYNAMICS

Mohamed Tarmizi Ahmad, Anudiipnath Jagannathan, Razali Abidin, Mohd Nor Hafizi Noordin, Norzaima Nordin, Amzari Zhahir

Abstract: The paper presents an analysis of gases flow through the convergent-divergent nozzle using nozzle equations. The results are compared with simulated results from computer modeling using the CFD SOLIDWORKS software. In this analysis, several parameters calculated from classical theory such as pressure, velocity, temperature, arear ratios are compared with CFD methods. The nozzle geometry is used in CFD software to generate the mesh. These results were then constructed to differentiate them from the analytical values. The results obtained by theory are identical to that obtained by computational modelling (CFD).

Panel: Aerodynamics

ID038

A STUDY OF 3D PRINTED BOX STRUCTURE

Wahyu Kuntjoro, Iz'Aan Syafiq Roslan, Atikah Basyirah Abdul Muta'Ali, Nur Izyan Azlaili Khairill Anwar, Rizal Effendy Mohd Nasir

Abstract: Unmanned Aerial Vehicles (UAV) are commonly used for surveillance and aerial mapping. Balsa wood construction is common for small UAV. However, for larger UAV size, balsa construction can be too fragile. 3D printing based airframe can help in producing accurate profile contour needed in a wing design, particularly on Blended Wing Body (BWB) design. Nowadays, 3D printing machines are not expensive and easily available. Flight Technology and Test Centre (FTTC) RIG, Universiti Teknologi MARA (UiTM) has been developing and building small BWB UAV made of 3D printing. At the moment, the strength and stiffness of the wing box structure has not been properly investigated. The general target of this research is to understand the static mechanical behaviour of a small wing box suitable for UAV manufactured by 3D printing. A simple wing box that can be produced on in-house 3D printer was produced. Standard tensile test was conducted to the PLA (Polylactic Acid) printed material. Finite element simulation of the wing box was performed, and static test experiment was conducted. Stresses and displacements were obtained and analyzed.

Panel: Structures & Materials

ID039

EXPLORATORY STUDY ON DEPLOYABILITY OF DISTRESS CALL BIRD REPELLENT SYSTEM AT WALTON AERODROME, PAKISTAN (A METHODOLOGICAL APPROACH)

Abdullah Ashfaq, Abdul Moeez, Nabeel Abid, Arslan Asim

Abstract: This study provides the methodological approach for deploying bird repellent system at airport. The airport chosen for deployability is Walton Aerodrome Lahore, and system for deployment is distress call system. The project is divided into two categories, evaluation of airport and distress call system effectiveness check. Evaluation process of Walton Airport consists of survey of Pilots as well as Engineers, and observation of airport. During evaluation it was identified that Black Kite, Crow and Pigeon are the 88% of total number of birds and responsible for 95 % of bird strike at aerodrome. It was identified during distress call system effectiveness check that system works effectively on Pigeons, also the habitual condition, nesting behavior, and attraction of crows is identified. The system displays variable response depending on weather, location and bird type. However, careful evaluation of the associated factors in the context of the device can result in improved results.

Panel: Airport & Operations

ID040

MISSION ANALYSIS OF 90 PAX HYBRID AIRCRAFT FOR SUSTAINABLE AVIATION

Devendra Singh, Abhay Pashilkar, Rajkumar Pant

Abstract: The technical feasibility of Electric or Hybrid propulsion system for regional turboprop passenger aircraft is being explored by present day aircraft designers with an aim to promote green and sustainable Aviation. This paper describes a procedure for sizing and mission analysis of a twin-turboprop 90seater aircraft hybridaircraft. We have replaced more powerful engine in the baseline configuration with a smaller engine along with electric motors. We define the powertrain modeling as parallel hybrid model with gas turbine engine and electric motors powered by separate energy sources. We have focused on the cruise segment of flight to check the feasibility of fully electric or partly electric cruise segment. A mission of 800 km block distance has been specified to evaluate the requirement of battery parameters like specific energy density, specific power density, fuel burn, CO2 emission and cost of flight. There is 45% reduction in fuel burn and CO2 emission and 5% reduction in DOC for hybrid variant in comparison to conventional aircraft.

Panel: Design & Performance

ID041

CO2 EMISSIONS REDUCTION THRU CREATING A MORE SUSTAINABLE AIRLINE'S NETWORK OPERATION FOR EUROPE

Daniel van der Mee Mendes

Abstract: Reducing CO2 emissions in the aviation industry is needed to accommodate the predicted growth in passenger numbers and movements when following the targets of the Paris Agreement. A focus area of reducing CO2 emissions is optimising operational aspects of the aviation industry. This research focuses on analysing and benchmarking the bigger European airlines on their CO2 emissions per passenger nm with the use of flight schedules, fuel burn numbers, fleet and seat configurations and load factors. Low-cost carriers produce less CO2 emissions per passenger nm than full service carriers with Transavia as the airline with the least CO2 emissions. The average flight distance is decisive of this ranking and is closely followed by the load factors. Nevertheless, there is still a gap between Transavia and a best possible network option based on CO2 emissions. Therefore, airlines must focus more on operational improvements to become sustainable by reducing their CO2 emissions.

Panel: Airport & Operations

ID042

METHOD FOR INCREASING STABILITY AND CONTROLLABILITY WHEN MOVING ON THE GROUND OF AN UNMANNED AERIAL VEHICLE OF AN AERODYNAMIC SCHEME OF A FLYING WING

Andrey Smagin, Oleg Dolgov, Boris Safoklov

Abstract: This paper discusses the possibility to introduce an integrated control loop for landing gear systems for an unmanned aerial vehicle of the aerodynamic scheme "flying wing" in terms of movement on the ground. The analysis of peculiarities of movement on the ground is carried out disadvantages and limits of application of available control methods are specified. Development of a dynamic aircraft model for virtual testing of control algorithms is described.

The development can be used on manned and remotely piloted aircraft as an auxiliary system that helps the pilot to withstand take-off and flight direction under random energy disturbances, similar to the ESP (Electronic Stability Program) auxiliary systems used on modern cars - an electronic dynamic stabilization system.

Panel: Guidance & Control

ID044

COMPUTATIONAL AERODYNAMIC ANALYSIS OF UITM'S HAWKEYE UAV AIRCRAFT

Zurriati Mohd Ali, Mohd Syazwan Johari, Wirachman Wisnoe, Noor Iswadi Ismail, Iskandar Shah Ishak

Abstract: This paper discusses the aerodynamic characteristics of Hawkeye UAV aircraft with a forward-swept wing configuration. The unconventional wing design on Hawkeye allows for better manoeuvrability and stability during a field test but there were no prior studies on its aerodynamic characteristics. A series of CFD simulations were conducted using ANSYS Fluent to obtain the aerodynamic characteristic of Hawkeye; lift, drag and moment coefficient. A full-size model and a numerical method based on Reynolds-averaged Navier–Stokes (RANS) equations, Spalart–Allmaras (S–A) turbulence model was used for the simulation. The angle of attack for Hawkeye was varied from -10° to 30° with an increment of 2° at a flight condition of Mach number 0.1 (~35 m/s). The CFD results obtained will be used to calculate the aircraft performance in a real field test and for future improvement of the UAV.

Panel: Aerodynamics

ID045

COLLABORATIVE ALLOCATION OF SLOT FOR ARRIVAL FLIGHTS IN MULTI-AIRPORT TERMINAL AREA BASED ON THE TRAFFIC FLOW PATTERN : A CASE STUDY OF SHANGHAI TERMINAL, CHINA

Lina Ma, Yong Tian, Songtao Yang

Abstract: In order to solve the increasingly serious congestions and delays in busy airports, the problem of collaborative arrival slot allocation for multi-airport terminal is investigated in this paper. With the premise of ensuring operation safety and the goal of minimizing total delay, the specific pattern of arrival traffic flow in the terminal area is considered in optimization modelling, and an improved genetic algorithm is designed for effective solution, followed which a simulation experiment of Shanghai terminal in China is conducted based on analyzing the spatiotemporal characteristics of the arrival traffic flow in it. The results show that the proposed method in this paper is able to reduce the total arrival delay in Shanghai terminal by 18.67%, and the delay on three runways in the terminal is cut down by 14.56%,19.35% and 25.37% respectively, indicating a significant improvement in operation efficiency of the total system..

Panel: Airport & Operations

ID046

AERODYNAMICS PERFORMANCE OF SELIG AIRFOIL THICKNESS USING COMPUTATIONAL FLUID DYNAMICS

Adi Azriff Basri, Sarveshwaaran Balakrishnan, Ernnie Illyani Basri, Muhamad Hasfanizam Mat Yazik

Abstract: The ideal way to increase aerodynamic efficiency of UAV flight performance is to select airfoil with best aerodynamic characteristics. S1223 airfoil has been selected due its advantages of aerodynamic properties and its performance in low Reynold number applications. Currently the effects of different thickness of Selig 1223 airfoil on aerodynamic performances at take-off condition for UAV is investigated. In this study, the Transition-SST turbulence model is applied in CFD for all simulations. The S1223 wing model has wing span of 0.8541m and chord length of 0.3048m. Variable thickness of Selig 1223 wing is utilized to mimic a morphed wing phenomenon. There are three different thickness utilized which are 50%, 100% and 150% thickness of wing. The 50%, 100% and 150% have coefficient of lift value of 0.575, 0.936 and 1.595 respectively. Hence, from this study it is clear that the increment in the thickness provides better aerodynamic performances at take-off condition.

Panel: Aerodynamics

ID047

DYNAMIC BEHAVIOUR COMPARISON OF QUADCOPTER BASED ON THRUST DIFFERENTIAL AND TILTED ROTOR

Mohd Razip Abdullah, Wahyu Kuntjoro, Rizal Effendy Mohd Nasir

Abstract: This paper describes the comparison of dynamic behavior of quadcopter between thrust differential and tilted rotor. The thrust differential is obtained by applying non equal thrust between front and rear motors while the tilted rotor has a control mechanism by tilting the rotors. The equations of motion were derived using Newton's second law, and simulated in the Simulink. The focus of the work is on the longitudinal mode behavior and during hovering. From the results, the more of thrust differential force and tilted rotor angle, the more the quadcopter moves forward and downward. It also shown the thrust differential based control displacement motion gradient is steeper than tilted rotor.

Panel: Guidance & Control

ID048

VALIDATION OF LOW FIDELITY PROPELLER-WING MODELING METHOD AT LOW REYNOLDS NUMBER

Baizura Bohari, Ahmad Zaim Adam Ghazali, Mohd Rashdan Saad

Abstract: The proposed concepts of having distributed propeller at the leading edge over the entire wing surface is far from new but was so far that its benefit not fully exploited to produce products. For some reason, the complexity of analyzing the flow mechanism that involved the coupling of propellers and wing aerodynamics seemed to be one of the obstacles. Hence, the introduction of slipstream effects induced by the distributed propeller at low Reynolds number will lead to notable reductions in aerodynamics efficiency with significance changes of the free-stream properties of the wing. To address the issues, a set of reasonable aerodynamic design method for multiple propeller-wing integration is necessary to capture the wing aerodynamics performances behavior at low Reynolds number. In that respect, the flow condition of a rectangular wing with NACA0012 airfoil section under the influence of the propeller slipstream was simulated and validated using low-order fidelity solver. A validation of the methods chosen found to be assuring in comparison with experimental data. The effects of various parameters were taken into account like the angle of attack, the rotational speed, the thrust and the power required. The aerodynamic aspect of the propeller-wing integration for a number of actuator disks propeller modeled distributed along the span of the wing of the aircraft is measured. The results show the role of propeller diameter and the numbers installed along the wingspan lead to a significance increase on lift performance and lift to drag ratio.

Panel: Aerodynamics

ID049

SYSTEMS ENGINEERING FROM ISLAMIC PERSPECTIVE

Ahmad Alsudairi, Azmin Shakrine Mohd Rafie, Abdullah Algarni, Syaril Azrad Md Ali, Ezanee Gires

Abstract: Even though modern systems engineering (SE) practices came from the West, there are other countries with success stories in SE implementation. China is the best example of that. Since the 1960s, the Chinese scientists -mainly Qian Xuesen - were tailoring the Western SE to fit their case. They had the right combination between Qian's experience in US aerospace and defense industry, the Marxist theories, actual China needs at that time, and the ancient Chinese philosophies. This success in SE implementation raises a question if looking to SE from an Islamic perspective would improve the practice in Islamic countries (e.g., Saudi Arabia, Malaysia). This paper is intended to explore the success opportunities of a tailored SE to fit Islamic countries.

Panel: General

ID050

THE EFFECT OF STREAMWISE LOCATION OF MICRO VORTEX GENERATOR ON AIRFOIL AERODYNAMIC PERFORMANCE IN SUBSONIC FLOW

Irahasira Said, Baizura Bohari, Azam Che Idris, Mohd Rosdzimin Abdul Rahman, Mohd Rashdan Saad

Abstract: Micro vortex generator (MVG) has been widely used in improving aerodynamics performance. The capability to contribute in drag reduction is reliable and have been tested in previous studies. This study proposes several ways to control drag coefficient by using MVG in counter rotating position to investigate the optimum location of micro vortex generator for different angles of attack that varies from 3° to 21°. The MVG positions were tested from 10% to 60% of the chord length to study the effectiveness on aerodynamic performance. This is to achieve the best lift coefficient and drag coefficient and subsequently lift to drag ratio with the instalment of MVG in wind tunnel under subsonic flow. The overall test shows optimum location of the MVG instalment is at 30% of the chord length and the optimum angle of attack is 3º that exhibits the best improvement in lift-to-drag ratio.

Panel: Aerodynamics

ID051

INTERNAL FLOW DYNAMICS AND PERFORMANCE OF PULSE DETONATION ENGINE WITH ALTERNATIVE FUELS

Muhammad Hanafi Azami, Mahammadsalman Warimani, Sher Afghan Khan, Ahmad-Faris Ismail

Abstract: Pulse detonation engine (PDE) is regarded as a propulsion system for future aircraft. The mode of combustion is supersonic in PDE. It quickly burns a fuel-air mixture (this means tens of thousands more rapidly than with a flame), which uses repeated detonation to induce thrust. In this study, the ANSYS FLUENT program conducted two-dimensional Computational fluid dynamics (CFD) simulation using a stoichiometric mixture of three fuels: hydrogen-air, methane-air, and kerosene-air. Time-dependent numerical simulations were used to explore the flow condition inside the detonation tube. Studies are often done with various grid sizes. Detonation parameters like pressure, temperature, detonation velocity, and performance parameters like specific impulse was investigated. Finally, these simulated results were validated with the previously-published literature and NASA CEA (national aeronautics and space administration -chemical equilibrium with applications).

Panel: Aerodynamics

ID052

IMPLEMENTATION OF A FIVE-HOLE PROBE FOR INVESTIGATING THE FLOW FIELD BEHIND A PERMEABLE HEMISPHERICAL PARACHUTE

Fakhri Etemadi, Ramin Kamali Moghadam, Mahmoud Mani

Abstract: In this study, five-hole probe was used for calibration of a wind tunnel and also for investigating the complex three-dimensional flow field behind a parachute model. The five-hole probe was calibrated by employing the structured Bayesian neural network method. According to the calibration, for the probe conical angle of 0~30 degrees, the accuracy of pitch and yaw angles were found to be around ±0.45 and ±0.9 degrees, respectively. For conical angles higher than 30 degrees, the accuracy of pitch and yaw angles were measured to be around ±2.5 degrees. At the next step, the probe was used to survey the velocity, pressure and other characteristics of the flow field at two middle and side planes. These measurements were performed at different distances from the parachute model and for velocities of 15 and 20 m/s. Further, in this study, the effect of freestream velocity on the flow physics behind the parachute model was examined in detail. Lastly, the experimental results were compared with the numerical simulations that were obtained through Fluent software with the assumption of parachute permeability. Moreover, as the supporting bar was not modelled in the numerical simulations, its effect on the experimental results was studied by drawing a comparison with the numerical results. The results revealed that a pair of large counterclockwise vortices and a pair of secondary clockwise vortices were induced behind the parachute. It was shown that compared to the numerical simulations, the presence of supporting bar weakens the secondary vortices in the side plane.

Panel: Aerodynamics

ID053

CFD ANALYSIS OF BETA-TYPE STIRLING ENGINE BY USING FINS AS REGENERATOR

Thavamalar Kumaravelu, Syamimi Saadon, Abd Rahim Abu Talib

Abstract: The Stirling engine is an externally heat engine closed loop with a high theoretical performance and low emissions compared to other conventional engines. This property nowadays becomes very advantageous due to its multi-fuel capacity including solar, biogas and geothermal energy. In this study, a numerical investigation of the effect of a circular, pin, and rectangular fins on the performance of the Stirling engine is introduced. The 3D CFD model was performed and validated with previous experimental study. The power output, heat transfer rate and efficiency were studied for all cases of fins. The results indicated that a close agreement between the numerical and the experimental results with an accuracy of about 96%. The efficiency decrease with the increase of the rotational speed of the engine and the highest efficiency is indicated for rectangular fins.

Panel: Aerodynamics

ID054

FIGHTER AIRCRAFT CLOSED LOOP HANDLING QUALITY SIMULATION ON LATERAL-DIRECTIONAL MODES

Hindawan Hariowibowo, Hari Muhammad, Hisar Pasaribu, Ony Arifianto

Abstract: In the early stage of fighter aircraft development, handling quality (HQ) become an important aspect in evaluating design results. One aspect of handling quality which involving pilot-in-the-loop, known as closed loop handling quality (CLHQ) will determine aircraft acceptability to fulfill its operational requirements. This paper explains the dynamic model of fighter aircraft for lateral-directional motions and simulate the CLHQ. The dynamic model consists of aircraft equation of motion and flight control system. In order to make CLHQ simulation, a pilot model must be added to the dynamic model. The simulation results are utilized to evaluate the sensitivity of the parameter values inside the elements of the dynamic model and pilot model. Also, the current simulation results of CLHQ will be used for an evaluation of aircraft Pilot-Induced-Oscillation (PIO) phenomenon.

Panel: Guidance & Control

ID055

VALIDATION AND VERIFICATION OF AERODYNAMICS LOADING OF SCHRENK APPROXIMATION, PRANDTL LIFTING-LINE AND COMPUTATIONAL FLUID DYNAMICS WITH EXPERIMENT ON A NACA SERIES

Nur Nabillah Mohd Kamal, Adi Azriff Basri, Ernnie Illyani Basri, Mohammed Thariq Hameed Sultan, Azmin Shakrine Mohd Rafie, Mohd Faisal Abdul Hamid

Abstract: Shape of an airfoil helps in minimizing pressure distribution on wing top surface where the lift force generated as the air goes faster towards it. Schrenk Approximation Method and Prandtl Lifting-Line Theory are useful in estimating the aerodynamics load of wing at the early stage of designing process. Whilst, Computational Fluid Dynamics (CFD) method is a modern alternative to a wind tunnel test that provide a great accuracy result. Yet, experimental method still holds the highest reliability compare to the others. A comparison of Schrenk method, Prandtl method, CFD and experiment in estimating the aerodynamic load at 0-degree angle of attack was conducted on NACA 4415 airfoil wing. The goal of this study is to determine the aerodynamic performance of the selected wing and to acquire the percentage difference of lift coefficient and lift force between all four approaches. From the study, Prandtl method and CFD shows a slight percentage difference between the experiment with the percentage obtained were 23% and 2% for lift coefficient and lift force respectively. Whereas, Schrenk provide a highest percentage difference among all approaches with 42% difference for both lift coefficient and lift force.

Panel: Aerodynamics

ID056

COMPUTATIONAL FLUID DYNAMICS MODELLING OF HYBRID ROCKET FLOW-FIELDS

Izham Izzat Ismail, Nur Husnina Aufa Rozainuddin, Muhammad Hanafi Azami

Abstract: A low regression rate is a major limitation in the hybrid rocket propulsion system. This project is to study the regression rate characteristics of a cylindrical solid grain with cryogenic propellants. Paraffin (P) fuel is coupled with two types of oxidizer, namely gaseous oxygen (GOX) and nitrous oxide (N2O). ANSYS software is used as the CFD platform to observe the hybrid rocket flow-fields. The modeling values obtained from the pressure, temperature, velocity, and wall heat flux contours are used to calculate the hybrid rocket performance in terms of regression rate, thrust, specific impulse, characteristic velocity, and exit Mach number. The numerical results show that the mass-flow-inlet boundary conditions, initial design feature, and type of propellant play an important role in the enhancement of hybrid rocket performance. Increasing the variables will increase performance. The GOX/P propellants exhibit the finest hybrid rocket motor with high performance due to high flame temperature.

Panel: Aerodynamics

ID057

COMPARATIVE STUDIES ON THE EFFECT OF AMINE/HARDENER (R) RATIO ON THE MECHANICAL AND THERMAL PROPERTIES OF EPOXY RESIN

Leong Shiijang, Dayang Laila

Abstract: Neat epoxy resin is a prepolymer that serve as a matrix material to employ in a wide range of application. The properties of this material are contributed by the structure of the epoxy group and its crosslink network formation with the amine. Recommended stoichiometric ratio formulation to produce optimum mechanical and thermal properties is often obtained empirically and based on certain specified application. Further essential information related to the investigation is in proprietary and not discussed. Consequently, this comprehensive review article is particularly emphasised on the effect of different amine/epoxy ratio to the (a) mechanical and (b) thermal properties. Several insights related to the changes in microstructure due to the off stoichiometric ratio is explained accordingly. Moreover, thermal properties focusing on the glass transition temperature, Tg is presented with the relationship with crosslink density, free volume and stiffness of crosslink chains in the network. While discussing the chemical stoichiometry, this review article also delivers an insight on how considerable curing condition improve these off stoichiometric epoxy resin properties.

Panel: Structures & Materials

ID058

CONCEPTUAL DESIGN AND INTEGRATION OF LARGE LITHIUM BASED BATTERY PACKS FOR ELECTRIC VEHICLES

Ranjan Vepa, Isil Yazar, Fikret Caliskan

Abstract: Following a review of the battery models available for electric vehicles, an accurate lithium-ion battery cell is used to construct a model for battery packs consisting of several cells arrange in series and parallel. The model is ideally suitable for electric vehicle and hybrid energy systems modelling, design and applications. The main intention of this paper is to investigate and analyze battery pack models assembled from cell models described by nonlinear sets of equations. Though there have been many cell level battery models found in literature adopting different methodologies, a detailed study revealed that equivalent battery pack models can be constructed as nonlinear interconnected networks of cells which could be widely applied due to simplicity and adaptability. The simulation results are being generated for Lithium-ion batteries which could be compared with experimental data to investigate the accuracy and validity of the battery pack model. The interconnect network model serves as a building block that can be used to construct the large battery packs based on a proven equivalent electric circuit cell model which was developed and reported earlier..

Panel: Design & Performance

ID059

DAMAGE ASSESSMENT ON NUMERICAL MODELLING OF ROTATING ENGINE BLADES SUBJECTED TO BIRD STRIKE

Sharis-Shazzali Shahimi, Nur Azam Abdullah, Meftah Hrairi, Meor Iqram Meor Ahmad

Abstract: This paper presents a numerical modelling of rotating engine blades subjected to bird strike using SPH modelling. Several assumptions have been made to model the bird as a gelatine structure and geometry and material model is utilised in this study. The bird model itself is modelled as a Smoothed Particle Hydrodynamics (SPH) to accurately represent a real bird impact especially during take-off and landing. As such, the engine blades impacted by the bird is modelled as a tetrahedron elements in commercial software of LS-DYNA. The engine is rotating in the z-axis at 200 rad/s counter-clockwise. The material of the blade is modelled with a Johnson-Cook failure constants. The numerical framework is validated with previous literature. The computational results are presented as effective stresses and shows that the structural damage due to impact is significant such that the bird strike causes deflection that will damage the engine blades.

Panel: Structures & Materials

ID060

INVESTIGATION OF THERMODYNAMICS PERFORMANCE OF JET ENGINE IN FLIGHT ELEVATION

Mehmet Ziya Söğüt, Enver Yalcın, T.Hikmet Karakoc

Abstract: Global warming and climate change have made it important to control emissions in the aviation industry. However, thermodynamic efficiency criteria are an important criterion for sustainable performance evaluation in engine technologies based on fossil fuel consumption. In this study, thermodynamic performances of flight altitudes were examined separately by taking a turbojet engine as a reference. In the study, energy and exergy analysis for each altitude condition related to the first and second law of thermodynamics were evaluated separately. In the study, the average thermal efficiency of the motor was 34.3%, and the exergy efficiency was found to be 25.68% on average. In the study, by evaluating the efficiency potential with thrust change, exergy destruction due to irreversibility were investigated. At the end of the study, some suggestions were made for system evaluations based on fuel flow.

Panel: Propulsion & Power

ID061

INVESTIGATION OF ENTROPY OPTIMIZATION RELATED TO THRUST CONTROL FOR JET ENGINE IN ATMOSPHERIC ELEVATION

Mehmet Ziya Söğüt

Abstract: In airplanes, the flight performance of the engines is directly related to the climate conditions as well as the technical competence of the engine. However, thermal losses due to irreversibility are also the main cause of environmental pollution. Although these potentials, which increase entropy generation, differ for each layer, they also depend on the direct or indirect fuel consumption of the aircraft. In this study, first of all, the exergy efficiency and entropy performances of the engine were examined by considering the parameters of a turbojet engine under flight conditions. In addition, the improvements that can be achieved in the system with the effective parametric controls of the engine were analyzed in terms of both efficiency and entropy in the system. At the end of the study, especially the environmental performances related to process analysis were evaluated with the developed environmental performance index (EPI) and Sustainable index (SI).

Panel: Propulsion & Power

ID062

SURFACE ROUGHNESS OPTIMIZATION INVESTIGATION OF AL6082 AVIATION ALUMINUM ALLOY

Ömer Secgin, Mehmet Ziya Söğüt

Abstract: It is very important to use light and durable materials in the production of parts for the aviation industry. Due to their technical properties, aluminum alloys largely meet this need. Therefore, aluminum alloys are used in the manufacture of airplanes parts such as stop beam, blisk, window frame. For these parts to be assembled and used correctly, their surface roughness must be within certain tolerances. In this study, surface roughness optimization was made in the machining of AL 6082 aluminum alloy. Spindle speed, pass amount, and feedrate are selected as operating parameters. Optimum parameter levels for the direction perpendicular to the cutting process: 1000 rpm, 0.5 mm Ap, 150 mm feedrate. Optimum parameter levels for surface roughness in the direction parallel to the cutting process: 3000 rpm, 0.5 mm Ap, 150 mm federate.

Panel: Structures & Materials

ID063

CONCEPTUAL DESIGN AND MISSION ANALYSIS OF HYBRID-ELECTRIC SHORT-HAUL AMPHIBIAN AIRCRAFT FOR SUSTAINABLE AVIATION

Nouman Uddin, Devendra Singh, Rajkumar S. Pant

Abstract: Amphibian aircraft can take-off and land from water bodies as well as from land-based airports. Conventional aircraft engines emit a lot of CO2 and GHGs, which can be lowered by the use of electric engines. There are plenty of opportunities for operating amphibian aircraft as their infrastructural requirements are much lower compared to those of the conventional aircraft. Use of amphibian aircraft can help in developing a low-cost sustainable Aviation eco-system. This paper summarizes conceptual design studies of hybrid-electric amphibian aircraft which can be used for civilian operations for short-haul passenger transport missions. The study has been carried out for a turbo-electric variant to assess the feasibility of battery technology available. Payload-Range study has been carried for various battery energy density and electric energy available on the aircraft. It has been observed that to meet the design range requirements, a low battery energy fraction of less than 30% and high battery energy density of more than 700 Whr/kg will be required.

Panel: Design & Performance

ID064

MULTI-ROTOR UNMANNED AERIAL VEHICLE (UAV) AERODYNAMIC PERSPECTIVE OF DIFFERENT PROPELLER BLADE DESIGN: A REVIEW

Fariduddin Ahmad Faris, Adi Azriff Basri, Ernni Illyani Basri, Ezanee Gires, Mohammed Thariq Hameed Sultan, Kamarul Arifin Ahmad

Abstract: The paper reviews the literature on propeller blade in terms of design and evaluation performance in the field of aeronautics. The purpose of this paper is to conceptually identify the work on propeller blade, particularly for Unmanned Aerial Vehicle (UAV) technology and provide in-depth technological applications with engineering systems. The paper discussed the evolution of propeller blade in terms of working principle and evaluation performance, whereby all researchers attributed these capabilities both in simulation of Computational Fluid Dynamics (CFD) and experimental studies. Implementing propeller blade design has proven its improvement on airfoil shape, chord length, angle twist and blade angle of attack through various optimisation methods. To date, there is insufficient reviews on the blade position of origin and provides comprehensive understanding regarding this topic. This discussion will highlight the state-of-the-art research area on this optimum performance of propeller blade.

Panel: Aerodynamics

ID065

NUMERICAL ANALYSIS OF TESLA BLADELESS MICRO-TURBINE PERFORMANCE ON THE INDIVIDUAL PITOT TUBE INLET

Farah Nur Diyana Salim, Adi Azriff Basri, Ernnie Illyani Basri

Abstract: Tesla turbine is introduced to the world with a goal of replacing piston engine in generating more power and it is proven to be more efficient for low output application. However, all studies that had been conducted for one particular design failed to achieve high performance. Therefore, in order to prove the efficiency of this turbine, an investigation has been conducted using computational fluid dynamics on the performance of different opening inlet nozzle known as 1 opening and individual pitot tube opening. In this research, a validation with an existing manuscript showed an agreement before the comparison study of different opening on the inlet were investigated. The results showed that the configuration of 4 inlets with 4 openings (4i4o) produced higher velocity and pressure distribution compared to 4 inlet with 1 opening (4i1o). Hence, 4i4o also performed higher value of torque, thrust and power output compared to 4i1o with 10 times difference. The performance of the Tesla turbine with the optimum configuration stated proven a very significant increase than the previous research studies. Therefore, it can concluded that the introduction of 'pitot-tube' functional theory where it caters the gaps individually by having separate inlet for each of them performed huge impact of the tesla turbine performance.

Panel: Propulsion & Power

ID066

DEVELOPMENT OF TAILORED PRODUCT LIFE-CYCLE (PLC) FOR SMALL SOUNDING ROCKET DEVELOPMENT

Ahmad Alsudairi, Azmin Shakrine Mohd Rafie, Abdullah Algarni, Syaril Azrad, Ezanee Gires, Ibrahim Aljuhaim

Abstract: For sounding rocket, the design phases are executed in 6 main disciplines: Aerodynamics, Structures, Propulsion, Flight Dynamics, Guidance, Navigation, and Control (GNC) and payload. The design begins by tackling and iterating these disciplines at a conceptual level. Then, proceeding to a more detailed level. This paper introduces a review of sounding rocket design life-cycle, by presenting the design practices from the available literature. Then, a framework small sounding rocket design is introduced. Finally, conclusion and recommendations are introduced.

Panel: Design & Performance

ID067

COMPUTATIONAL STUDY OF MASS REDUCTION OF A CONCEPTUAL MICROSATELLITE STRUCTURAL SUBASSEMBLY UTILIZING METAL PERFORATIONS

Mohammad Yazdi Harmin, Sarmad Dawood Salman Dawood, Ahmad Salahuddin Mohd Harithuddin, Chia Chen Ciang, Azmin Shakrine Mohd Rafie

Abstract: A subassembly from the structural subsystem for a conceptual microsatellite designed for earth resources missions underwent normal modes analyses, after implementing an alternative approach to mass reduction, other than implementing advanced space qualified materials. This approach involved developing and implementing a set of geometric patterns that where imposed upon certain components of the structural subassembly as perforation patterns, hence achieving mass reduction through straightforward material removal. This approach was proposed to introduce a relatively low-cost and easily implemented mass reduction methodology, which can be utilized by entities with little or no infrastructure and experience in advanced materials, though aspiring to develop their own satellite development capabilities. The subassembly was the primary load path through which the launch loads pass, the so-called central box, consisting of four Aluminum 6061 identical planar plates, fastened together by titanium fasteners. The subassembly's fundamental natural frequency and attendant mode shape, for all cases, were computed utilizing the finite element method. The current work's approach to mass reduction resulted in an approximate percent reduction in mass of 20% from the unperforated case, depending upon the exact thickness value employed for the subassembly plates, hence indicating that the perforation approach is valid.

Panel: Structures & Materials

ID068

PERFORMANCE AND EXHAUST EMISSIONS RATE OF SMALL-SCALE TURBOJET ENGINE RUNNING ON DUAL BIODIESEL BLENDS AND SINGLE BIODIESEL BLENDS USING GASTURB

Yazan S. M. Altarazi, Abd Rahim Abu Talib, Ezanee Gires, Jianglong Yu, John Lucas, Talal Yusaf

Abstract: Gas turbines are designed to run on specific fuels such as conventional fuels, so researchers are working to find alternative fuels as biodiesel. The purpose of this study is predicting the engine performance and emissions rate for the turbojet engine running on dual biodiesel and its blend with Jet-A fuel. Besides that, this paper explores the different effect between Dual blends and Single blends. Calculate fuel parameters based on the physicochemical properties of each fuel to perform nine blends of dual biodiesel (B10-Jet, B30-Jet, B50-Jet, B70-Jet, and B90-Jet), and one single biodiesel blend (POME50: Jet-A50). Then the heat of combustion for each blend was obtained using the GasTurb Details 6. After that, the design point has been determined of the specific engine and operates it using alternative fuels to analyze performance and emissions characteristics. Results of this study were found that the B10-Jet blend gave the best specific fuel consumption (SFC) and emissions rate than Jet-A fuel and other blends.

Panel: Propulsion & Power

ID069

DIMENSIONAL ANALYSIS ON THE AERODYNAMIC PERFORMANCE OF COANDA AIRFOIL DESIGN

AHM Faisal, AR Abu Talib, ASM Rafie, A Filippone, H Djojodihardjo

Abstract: Active circulation control, in particular the Coanda effect, is an advanced flow control method that is able to harness the full potential of airflow in enhancing aerodynamic performance. The applications take advantage of the high lift benefits and the ability to directly control the flow field for the generation of lift and flight propulsion; offering the best solution to boost aerodynamic performance. A two-dimensional hemispherical shape model is developed to investigate the aerodynamic performance of the Coanda design concept. Employing the basic principles of fluid physics, via the momentum theory, the parametric aerodynamic performance is formulated. Following the formulation of the design, the model is further refined via a dimensional analysis to reduce the total number of variables required for the design analysis. Simplifying for the performance analysis, allow one to focus on the key physical parameters that strongly influence the aerodynamic performance of the design.

Panel: Aerodynamics

ID070

MULTIOBJECTIVE OPTIMISATION OF CIVIL TILTROTOR POWERPLANTS INCORPORATING REHEAT

Ezanee Gires

Abstract: This paper investigates the performance of multiple reheat configurations applied to a civil tiltrotor (CTR) powerplant. A Brayton cycle with reheat achieves higher specific power (SP) but raises specific fuel consumption (SFC). Mixed Integer Distributed Ant Colony Optimisation (MIDACO) was used to reconcile competing SP maximisation and SFC minimisation objectives when optimising conventional and reheat gas turbines. Parametric analysis showed that SP and SFC are sensitive to changes in overall pressure ratio and turbine work split. A component-based approach was used to estimate the weights of the conceptual engines. The optimisation constraints were helicopter mode takeoff power and power required at 240 kt fixed-wing cruise at 20,000 ft with CTR design gross weight. While the optimised sequential burner engine (SEQ) has a higher SP gain of 57.22 kW/kg/s, the SFC did not improve over the baseline (BL). The optimised baseline engine (OBL) and engine with inter-gas generator turbine-stage burner (ITB) reduced SFC by 10.83 µg/J and 9.37 µg/J from BL at design point (DP) power and increased SP by 8.24 kW/kg/s and 27.34 kW/kg/s, respectively. The optimal ITB is lighter than the baseline by 18.27% while the OBL engine is heavier by 3.21%. The range and hover endurance of the optimal ITB-CTR (495 NM, 1.32 hr) are comparable to the OBL-CTR (500 NM, 1.30 hr). The ITB-CTR has advantages over the OBL-CTR with higher SP and payload capacity (1304 lb versus 959 lb) while the reheat SFC penalty is reduced. The results show that placing a burner between turboshaft gas generator turbine stages imposes less SFC penalty than between gas generator and free power turbine stages.

Panel: Propulsion & Power

ID071

NATURAL FIBRE SANDWICH COMPOSITES AND THEIR AEROSPACE ENGINEERING APPLICATIONS

Norkhairunnisa Mazlan, Natasha Ramli, Yoshito Ando, Khalina Abdan, Zulkiflle Leman

Abstract: Sandwich composite is a special type of laminated composite composed of a mixture of different materials that are bonded to each other in order to take advantage of the structural advantage of the entire assembly of the properties of each separate part. A sandwich structure typically consists of two relatively thin, rigid and strong sides, for example, honeycomb, balsa or foam cores, separated by a relatively thick lightweight core. The aim of the sandwich structure is to achieve a stiff component that is light at the same time. Due to their bio-degradable behaviour and ease of processing, a natural fibre composite also plays a vital role in automotive and construction submissions. This paper discusses sandwich structures, various experiments and their properties carried out on them, along with some mechanical behaviour studies of natural fibre composites. In this work, significant applications of the sandwich specimens are also highlighted.

Panel: Structures & Materials

ID072

EVALUATION OF QUADROTOR FLIGHT AND BATTERY CONSUMPTION DURING TURBULENCE USING OPEN-JET WIND TUNNEL

M.N. Elya, S.N. Makhtar, S. N. M. Tawil, A. Bakar, M.R. Saad, S. Azrad

Abstract: This paper presents the results of battery consumption for quadrotor flight under wind turbulence condition. The study is performed at the open-jet wind tunnel. A motion capture system is developed at the exhaust part of the open-jet wind tunnel to perform this study. The motion capture system comprised of 6 optitrack cameras installed at the outside of exhaust part of the wind tunnel, and a PC at the ground station. The battery used is LiPo rechargeable battery. Two size of battery are used in this study which are 5200Mah and 4200mAH to evaluate the battery consumption over duration of flight.

Panel: Guidance & Control

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