

Letter from the guest editors

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Letter from the Guest Editors

Special Issue on Innovations for Sustainable Aviation

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According to the International Civil Aviation Organization, the world aviation air traffic has grown by an average yearly rate of 5% over the last thirty years, until the devastating downturn brought on by the COVID crisis of 2020. Regardless of the current situation, there are still a number of issues and challenges that the industry is confronted with, not the least of which are related to sustainability, the conversion to electrical usage, the challenge of increasing propulsion efficiency in conventional propulsion, the digital transformation of the entire ecosystem, etc. In response, system developers and researchers in the field are working on a number of key technologies and methodologies to solve some of these issues. The Sustainable Aviation Research Society (SARES), a global organization that seeks to encourage research in this area and helps disseminate knowledge via conferences and symposia, has been organizing meetings to promote sustainable aviation over the five years. Three of these are *the International Symposium on Sustainable Aviation (ISSA)*, *International Symposium on Electric Aviation and Autonomous Systems (ISEAS)*, and *the International Symposium on Aircraft Technology, MRO, and Operations (ISATECH)*. These symposia address current issues in the field of aviation such as

- Aircraft fuel efficiency improvement
- Fostering the use of biofuels
- Environmental impact minimization
- GHG emissions mitigation
- Engine/airframe noise reduction
- Full-electric aircraft/rotorcraft/UAV
- Hydrogen fuel cells for aviation
- Electrical aircraft for general aviation
- Chargers and battery systems in air vehicles

History

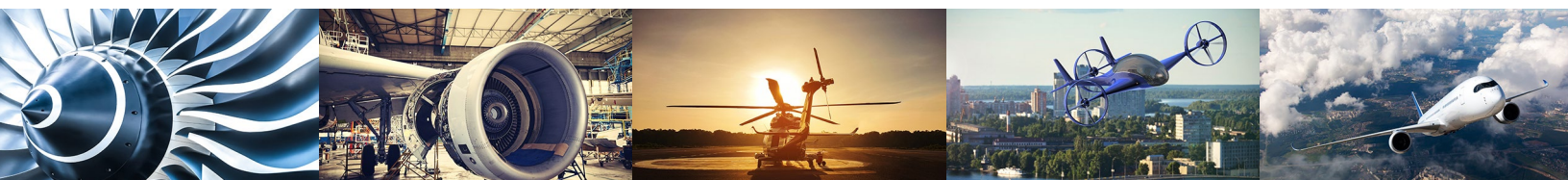
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- New aircraft architectures
- Advanced materials in engineering and manufacturing
- New maintenance strategies
- Aircraft connectivity
- Aircraft/MRO digitalization
- Data analytics, AI, and predictive maintenance
- Structural health monitoring
- Multilevel/hybrid modeling and simulation
- The latest innovations in aviation, aircraft, and air transportation

ISSA-2019 and ISEAS-2019 were held in Budapest, Hungary, in May 2019, while ISATECH-2019 was held in Amsterdam, Netherlands, in October 2019. This special issue, which is comprised of articles developed from presentations at the ISSA-2019, ISEAS-2019, and ISATECH-2019 conferences, gives an introduction to the important relationship between sustainable aviation, electric aircraft, aircraft maintenance, and airline operations. These articles contribute to the theoretical and practical scientific understanding of how we can design and implement a suitable, sustainable, environmentally benign, and low-cost transportation system. From the number of excellent papers presented at these symposia, the guest editors selected eleven articles which then went through additional reviews consistent with the standard journal peer-review process.

In the first article, Yetik et al. examined and compared lithium-ion and lithium-iron phosphate batteries. In addition, they investigated the thermal analysis of the considered batteries and emphasized the necessity of heat management in these battery systems.

The next article, from Körmöczi et al., also pertains to battery systems. The authors seek to fine-tune the efficiency of power utilization with the use of laser-assisted, filler-based joining to achieve battery cell connections with the least possible electrical losses. They present their experimental results on the effect of various process parameters on the electrical and mechanical behavior of the laser-formed bonds within battery cells.

In the next article by Turan and Topal, semi-empirical correlations for combustion efficiencies are examined, and correlation coefficients have been revised by using an experimental air-blasted tubular combustor using JP8 kerosene aviation fuel.

Sener et al. propose a turboelectric propulsion system's power-system architecture, which is based on the Inner Bus Tie architecture proposed by NASA. The single turbo-shaft failure mode, which was based on a GE T700 turboshaft engine, is analyzed and simulated using MATLAB/Simulink mathematical models.

Numerical simulation plays a key role in developing a more realistic analytical model for panel flutter analysis. The important feature of the article by Moosazadeh and Mohammadi involves using two methods for the aeroelastic analysis of the 2D shell with cylindrical bending. In the first approach, a supersonic viscous flow model is used along with the finite volume method (to discretize the full Navier-Stokes equations and nonlinear structural model. In the second approach, the problem is solved with a third-order piston theory aerodynamic (PTA) model, considering mechanical and thermal loads and neglecting the viscosity effects.

Sener et al. design an interleaved synchronous modular buck converter topology for DC to DC power conversion arising from more electric architectures in modern civil and military aircraft. Calculations for the converter design are conducted considering aviation standards, primarily applicable MIL standards.

The thermal analysis of lithium-ion batteries is investigated both experimentally and numerically by Yetik and Karakoc. The Laminar model is used under natural convection in computational fluid dynamics (CFD) analysis. Experimental studies are compared with those from the CFD analysis to validate the model.

Papanikou et al. focus on fatigue hazard identification and compared subjective and objective tools, which could be employed by a Fatigue Risk Management (FRM) system. They focus on an exploratory survey of 120 pilots and an analysis of 250 fatigue

reports, which are compared with objective fatigue assessment based on the polysomnographic and neurocognitive assessment of three experimental cases. They highlight the significance of predictive objective tools, which should be deployed by contemporary FRM models and present thoughts on how operators can rethink and restructure their processes to enhance FRM systems.

A hierarchical, four-stage, multilevel framework is established by Georgantzinou et al., starting from the nanoscale up to laminated hybrid composites. In this study, the elastic mechanical properties and responses of specific composite configurations in different mechanical tests are evaluated using finite element analysis. Comparisons with theoretical and other numerical techniques demonstrate the accuracy of the proposed technique.

In the next article, Koruyucu et al. apply energy and exergy analysis to turboshaft engines. The authors present an analysis technique for calculating various key parameters associated with rotorcraft turboshaft engines at various power levels. It is seen that the efficiencies of the engine increase with increasing engine power. Exergy destruction and exergy loss values are presented by calculating different powers in this article.

In the final article that rounds out this special issue, Mendoza et al. focus on aircraft trajectory optimization using a Particle Swarm Approach. Global warming has motivated the aeronautical industry to develop new technologies that will reduce fuel consumption and hence reduce environmental damage. The authors use a particle swarm approach to optimize flight paths under traffic management constraints. They show that significant fuel-burn savings can be achieved even when compared to actual trajectories. Because of the nature of the particle swarm optimization algorithm, the local best trajectories are extracted and provided as a trajectory option set, which are similar in cost to the optimal trajectory.

We hope that this special issue of the *SAE International Journal of Aerospace* will increase the awareness about innovations in sustainable aviation and will attract more attention to this important topic. We wish to express our deepest appreciation to the organizing committee and volunteers who have made the featured conferences unforgettable experiences. We would like to express our sincere thanks to all the reviewers of this issue who have generously contributed their time and effort to ensure that it lives up to the Journal's high quality.

We are also sincerely grateful to SARES (International Sustainable Aviation and Energy Research Society) and the staff of the *SAE International Journal of Aerospace*, and especially to Ravi Rajamani, Jonathan Neu, Kimberly Martin, and Christie Inman for their support in preparing this special issue.

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Find the online special issue [here](#).

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