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Editorial

Special Issue "Technologies for Future Distributed Engine Control Systems"

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Current trends in aviation greatly expand the use of highly integrated, increasingly autonomous air vehicles, with distributed engine control systems (DECS). Such systems allow for optimizing engine performance by enhancing propulsion control architecture. The weight of wiring and need for cooling are significantly reduced in the engine controlled by a DECS when compared to the traditional centralized FADEC. Each element of DECS, such as a sensor, actuator or controller, individually connects to the network and has multiple functions.

This Special Issue includes seven selected papers presented during AVT-357 Research Workshop on Technologies for future distributed engine control systems (DECS), held online, 11–13 May 2021 [1]. The event was sponsored by NATO Science and Technology Organization. The programme covered advanced hardware and software technologies grouped into the following sessions: Distributed Architectures, Control Systems, Chips and software, Smart Sensors and Diagnostic and Prognostic Systems. Compelling keynotes and papers were presented by speakers from universities, government research centres and industry from nine nations.

The key problems discussed during the meeting included:

- Reliability of engine control systems in the face of multi-core processing and the perceived perfection of consumer electronics;
- Balance between innovation and unforgiving demands for safe and rugged operational availability for military applications;
- Opportunities and limitations of AI-based control and prognostics;
- Standardization and certification of new DECS technologies.

This issue of *Aerospace* presents recent advances in gas-turbine engine control systems. The articles introduce novel engine control approaches, robust sensing solutions, high-temperature electronics and open architectures that can be applied in on-board systems. Their implementation will contribute to ensuring the required engine performance and reducing the overall cost of ownership.

Lytviak et al. [2] studied the self oscillations of the free turbine governor. The control system was modelled in two configurations: with the main rotor and with water brakes. The simulation results are invaluable for effective adjusting the hydromechanical governor. De Giorgi et al. [3] used two Nonlinear Autoregressive Neural Networks to predict the specific fuel consumption of a degraded turboshaft for several transient flight maneuvers. Rokicki et al. [4] proposed inductive sensor for measuring blade vibration in high pressure compressors and turbines and used a rotor rig and turbojet to validate it at elevated temperatures (200–1000 °C). Flaszynski et al. [5] discussed turbine stator's potential effect on flow in a combustor and the clocking effect on temperature distribution in a nozzle guide vane (NGV). It was shown that the NGV potential effect on flow distribution at the combustor–turbine interface located at 42.5% of the axial chord is weak. The clocking effect due to the azimuthal position of guide vanes downstream of the swirlers strongly affects the temperature and flow conditions in a stator cascade. Villarreal-Valderrama et al. [6] studied the possible advantages of an exhaust gas control through a variable exhaust nozzle in a micro turbojet. It was found that the proposed controller improves the expansion of the exhaust gas to the ambient pressure for the whole operating range of the turbojet, increasing the thrust by 14%. Popov et al. [7] demonstrated two designs of a more-electric turbofan in distributed architecture for small and medium-sized unmanned aerial vehicles. The pumps and guide vane actuators were electrically driven. Control and monitoring signals were transmitted via a digital bus. The functional and reliability analyses of each subsystem were presented. Templalexis et al. [8] compared the life consumption rate of the AE 3007 turbofan powering the surveillance and passenger variant of the Embraer aircraft (EMB-145 and EMB-135 LR). The rainflow method was used to determine LCF cycles, whereas the Larson - Miller parameter method was used to determine the consumed life due to creep of HPT blades. It was found that the engine in the EMB-145 military variant is much more loaded and has to be closely monitored.

I wish to thank Ms. Monika Vavrikova from AVT Executive Office and Dr. William D.E. Allan, the AVT-357 technical evaluator for their involvement and hard work with the workshop papers. With great pleasure, I would like to thank and congratulate the authors of accepted manuscripts who successfully expanded and revised their workshop papers to be published in this peer-reviewed Special Issue. Furthermore, the invited reviewers deserve praise and appreciation for their insightful critique and suggestions, which contributed directly to improving the technical content of the journal articles.

Finally, I would like to express my gratitude to Mr. Peter Liu and the editorial team of *Aerospace* for offering a possibility to publish a number of workshop papers and for their continuous support in preparing this Special Issue. I would also like to thank Prof Hany Moustapha, the AVT-357 co-chair, for his valuable support and advice.

Conflicts of Interest: The author declares no conflict of interest.

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