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MULTI-DISCIPLINARY DESIGN & OPTIMISATION OF NOVEL HEX (HEAT-EXCHANGERS) FOR GREEN AVIATION

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Abstract:

With an increased interest in electrification for aviation, attention is drawn to optimising the overall aircraft/engine thermal management, which involves designing more efficient heat exchangers (HEX). In this STS, various technologies and software available for both design and optimisation of cold-plate HEXs will be discussed and reviewed. The focus would be on methods that can both analyse the heat sources that represents power electronics components for aviation applications and also design new novel geometries to address the cooling requirements.

One of the key technologies we would like to discuss is the thermal-fluid topology optimisation [1] for HEXs for turbomachinery jet-engine applications. Some of the Key technologies for an optimum design of HEXs would be hi-fidelity conjugate CFD simulation, automatic meshing of very complex geometries, multi-physics simulation, advances in Additive-layering Manufacturing (ALM) as well as testing and experimentation to support the design. Novel shapes resulting from topology optimisation that could only be manufactured using ALM will also be exhibited and discussed. Furthermore, we explore how these technologies can be extended to other design problem like the optimum fuel passages for PEMFCs (Hydrogen Fuel Cells), etc.

Presentations are also expected from an ongoing R&D work as part of the EU Horizon Program (NextAir) to produce a fully-fledged Digital Twin of a Heat-Exchanger [2].

References:

[1] Raske, N, Ausin Gonzalez, O, Furino, S, Pietropaoli, M, Shahpar, S, & Montomoli, F. "Thermal Management for Electrification in Aircraft Engines: Optimization of Coolant System." Proceedings of the ASME Turbo Expo 2022, Netherlands. June, 2022. V06BT13A013. ASME. https://doi.org/10.1115/GT2022-82538

[2] NEXTAIR - multi-disciplinary digital - enablers for NEXT-generation AIRcraft design and operations, (**WP6:** Digital Twin of a HEX) - DOI: 10.3030/101056732, Sept 2022.