OS06 – Fluid Machinery in Propulsion Systems

Organizers: Tobias Traudt, Hideyo Negishi

This organized session focuses on fluid machinery in aerospace and rocket propulsion systems, where rotating machines operate under extreme flow conditions and play a critical role in overall system performance and reliability. The scope includes compressors, turbines, pumps, fans, turbopumps, and inducer systems that are integral to aircraft engines, space propulsion systems, and advanced launch and in-space transportation concepts.

Fluid machinery for aerospace propulsion is characterized by highly unsteady, compressible, and often multi-phase flows, involving phenomena such as shock–boundary layer interaction, cavitation, cryogenic fluid behavior, strong rotor–stator interaction, and fluid–structure coupling. In rocket propulsion systems, turbopumps and feed systems must operate with high rotational speeds, tight stability margins, and severe thermal and mechanical constraints, making accurate prediction and control of flow instabilities and dynamic response particularly challenging.

The objective of this session is to provide a forum for researchers and engineers to present recent advances in fundamental flow physics, high-fidelity numerical simulations, experimental investigations, and design methodologies related to aerospace propulsion fluid machinery. Contributions addressing both component-level phenomena and propulsion system integration issues are strongly encouraged.

Non-exhaustive list of suggested topics

- Turbomachinery for aircraft and space propulsion systems
- Rocket turbopumps, inducers, and propellant feed systems
- Cavitation, cryogenic flows, and multi-phase phenomena in propulsion machinery
- Compressible and high-speed flows in compressors and turbines
- Flow instabilities, surge, rotating stall, and cavitation-induced oscillations
- Fluid–structure interaction, flutter, and vibration of rotating components
- Advanced CFD, multi-physics simulations, and reduced-order models
- Experimental studies and diagnostics for aerospace propulsion machinery
- Design optimization and performance enhancement under propulsion constraints

Organizers

Tobias Traudt is a Senior Researcher at the institute for space propulsion of the German Aerospace Center (DLR). He is leading the turbopump technology team and is the project leader of the LUMEN project in which a rocket engine for research was developed. LUMEN uses two turbopumps which were developed by his team and are the basis for DLRs research activities on turbopumps. His main research interest is multiphase flows in pump inlets and during chilldown of turbopumps, rotordynamics, seal systems, hydrodynamic bearings and fluid mechanics. He and his team aim at developing new technologies with the focus on experimental validation in cryogenic environment.

Hideyo Negishi is a Senior Researcher at the Research and Development Directorate of the Japan Aerospace Exploration Agency (JAXA). He has been leading research and development in advanced numerical simulation technologies for liquid propulsion systems, with a particular focus on liquid rocket engines. Through these activities, he has contributed to the development of liquid-propellant launch vehicles, including the H-IIA/B and H3 programs at JAXA. His research interests span a wide range of computational fluid dynamics (CFD) applications relevant to aerospace propulsion, including turbopumps, combustors, propellant tanks, aerodynamic flows, and system-level simulations. His work emphasizes the integration of high-fidelity numerical modeling with practical engineering applications in launch vehicle development.

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