Master Thesis

Institute for Thermal Turbomachinery and Machine Dynamics

Numerical Simulation of a Counter-Rotating Two-Stage Turbine

Due to the outstanding growth of the air transport sector (and the stricter regulations in terms of noise and pollutants emissions), numerical and experimental investigations of turbofan aerodynamics have become more and more important in the last decades. The Institute for Thermal Turbomachinery and Machine Dynamics (ITTM) is fully involved in the research, with three test turbine facilities and an in-house developed code for CFD.
A new counter-rotating two-stage turbine setup (Fig.1) is going to be tested in the next months at the ITTM. It is representative of the last HP turbine and first LP turbine stage of a real engine, which are connected by a turning frame, integrating both structural and aerodynamic (LPT vane) functions. A CFD simulation of the presented configuration is required to provide additional insight into the flow features characterizing the turbine stages.

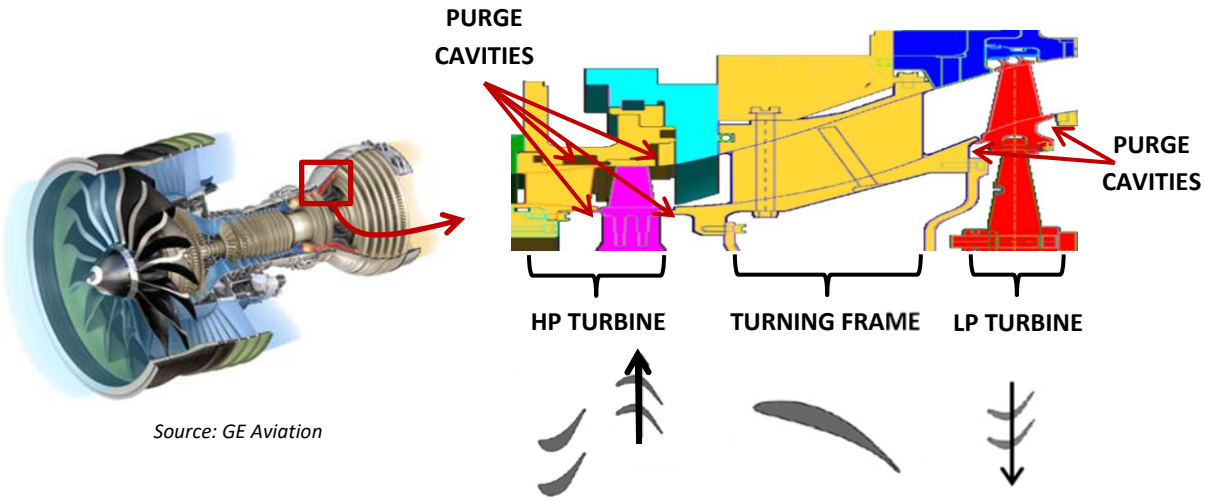

Figure 1 Modern turbofan architecture (left). ITTM two-stage test turbine cross-section (right)

The aim of the master thesis is to perform a RANS simulation of the experimental turbine flow, in order to highlight the most important flow structures and assess their origin. The cavities providing purge (or cooling) flows will also be modelled to get a deeper understanding of the ingress/egress interaction with the main flow.
The work plan consists of the following steps:

- Literature study to make the student familiar with the flow phenomena involved
- Mesh generation
- CFD calculation setup (boundary conditions, turbulence models, etc.)
- Data reduction and evaluation (via MatLab or Tecplot)

Duration: 6 months
Start date: available now

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