Aerothermal performance of fan outlet guide vanes in modern geared turbofan engines

Fluid Dynamics

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Background:
As industry is challenged to reduce CO2 emissions from aviation by 75% in 2050, radical technology is required. Hybrid electric concepts are a strategic way forward to achieve such ambitious goal. However, these concepts bring in additional challenges with respect to engine architecture, installation weight and heat management. At Chalmers radical concepts for heat management in new hybrid electric configurations are being investigated.

Description:
In the present project, the concept of using existing turbomachinery surfaces to reject generator heat is proposed. In particular, the aerothermal performance of a new Fan-OGV (outlet guide vane) heat sink will be investigated. The project will cover different OGV designs ranging from standard (Figure 1, top) to low aspect ratio and low blade count concepts (Figure 1, bottom). The initial low-pressure system design is provided by our industrial partner GKN Aerospace in the framework of an ongoing project. The students are expected to establish the performance of such a system, and to design the inner cooling circuit that deliver the required heat exchanger performance with minimum pressure losses. The work is supported by CFD RANS and heat transfer calculations.

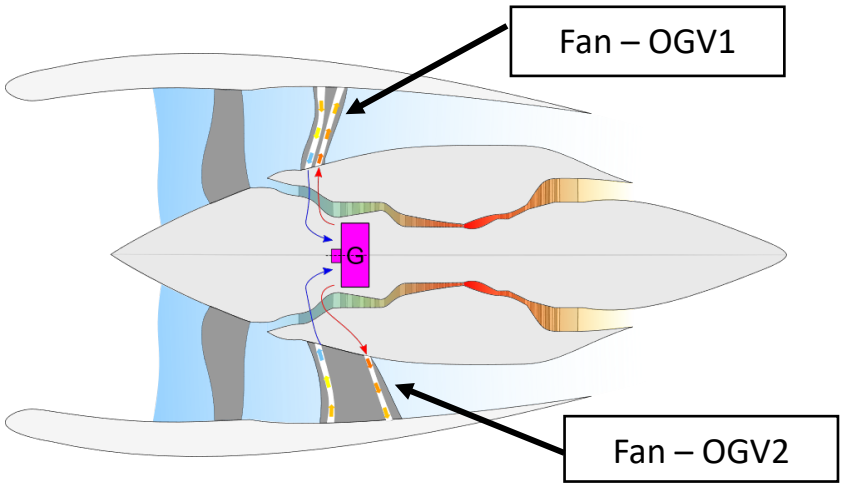

Figure 1: Cross-sectional drawing of a gas turbine engine with OGV integrated heat sink. Top: Conventional OGV design (OGV1). Bottom: low aspect ratio OGV design (OGV2)

Student profile:
The students are expected to have a good background in CFD and a solid knowledge in turbomachinery (or gas turbine technology). After completion the student is expected to be familiarized with complex heat transfer problems and with the design and aerodynamic performance of transonic Fans.