Brandenburgische Technische Universität Cottbus - Senftenberg

AVL

Call for Master Thesis Student

Feasibility study for the „Evaluation of the jet engine water intake during critical flight stages through a hybrid numerical simulation model“

Significant progress has been achieved during the last decades In the research and development of new jet engines. As an example we can cite a reduction of up to 43% in the fuel consumption per passenger and km between 1990 and 2019 due to different measures (Source: Bundesverband der Luftverkehrsgesellschaft, BDL). Numerical simulations have played a decisive role, since they contributed to a better understanding of the physical phenomena and engineering details inside the jet engine.

There are certain issues, however, which still can only be partially addressed, or not addressed at all, with traditional numerical simulation models. The alternative is to resort to very time-consuming and resource-intensive detailed simulations which are generally not feasible for the aviation industry.

The analysis and evaluation of the water intake in the jet engine during critical flight stages is one of such challenging issues (see Figure).

The objective of this call is to perform a feasibility study for the application of a new hybrid numerical simulation model that aids in the analysis of the water intake in jet engines in the context of a Master Thesis. The intake and transport of water in the engine and downstream to the low pressure compressor needs to be calculated by means of the particle flow simulation program PREONLAB based on an implicit SPH model (Smooth Particle Hydrodynamic). The air flow as a necessary boundary condition for the water transport can be calculated based on a Finite Volume Method CFD approach carried out with the AVL code FIRE M.

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Tasks required in the context of the Master Thesis:

1. Getting familiarized with the CFD software FIRE M and PREONLAB. AVL and the Chair of Numerical Fluid and Gas Dynamics will be supporting the student n this task.
2. Setting the numerical mesh required for the Finite Volume Method simulation of the initial air flow The simulation, which needs to be carried out with the AVL CFD code FIRE M, should consider the air flow for the critical load case of a landing with reduced engine performance.
3. Setting the numerical model in the SPH solver PREONLAB and carrying out the simulation for the water intake in the jet engine considering the previously calculated air flow.
4. Evaluating the influence of the adhesion factor on the results for the discharge of the water flow onto surfaces and to the fan.
5. Analysing and presenting the results by means of 3-D animations.

Contact at BTU:

Prof. Heiko Schmidt

Chair of Numerical Fluid and Gas Dynamics

Tel. : +49 355 69 4874

Email: heiko.schmidt@b-tu.de

Contact at AVL:

Dr. Alexander Oliva

Solution Expert

Tel.: +49 89 307497497 465

Email: Alexander.Oliva@avl.com