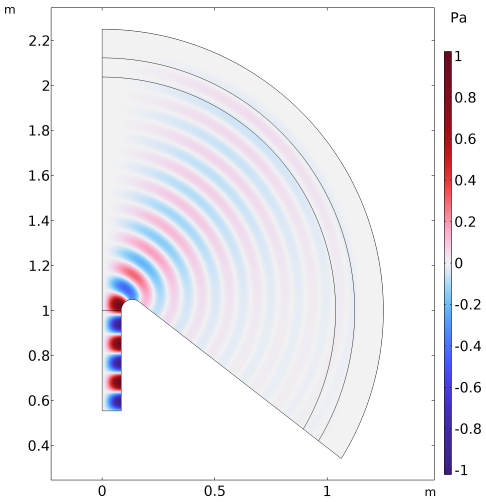
Chair of Vibroacoustics of Vehicles and Machines
TUM School of Engineering and Design
Technical University of Munich

Semester project or master thesis (theoretical/numerical)

Mode detection of fan broadband noise using microphone arrays

Topic

In order to reduce fuel consumption, turbofans with increasing bypass ratios have been designed over the years. This led to the development of Ultra-High Bypass-Ratio (UHBR) aircraft engines with modified geometries compared to previous turbofan configurations. This also has an impact on the relative contribution of sound sources: as a result, the fan noise contributes to $50\% - 65\%$ of the overall sound power. A good understanding of noise generation mechanisms due to the rotor-stator interaction is crucial to developing new noise reduction concepts. For the validation of these new technologies, an experimental assessment is often carried out by means of scaled tests.
Rotor-stator interaction noise is described by acoustic modes that are determined by numerical or analytical calculations and experimental measurements. In the framework of this thesis, first, the limits of the current mode analysis technique are evaluated and then improved.



Acoustic mode propagation into the far-field.

The focus lies particularly on increasing the complexity of the simulation by incorporating more sophisticated background flow models. The aim is to investigate not only the effects of the rotor-stator interaction but also the impact of complex flows.

Tasks

- Literature review on rotor-stator interaction noise and modal detection techniques
- Implementation of a numerical simulation using the multiphysics software COMSOL
- Comparison to existing models and gain in knowledge

Requirements

- High interest and knowledge in the area of (aero-) acoustics or computational methods required
- High interest in the area of numerical simulation
- Please provide a short personal cover letter (not generated by large language modeling) and your transcript of records

Benefits

- Insight into the field of computational acoustics
- A nice workspace and IT infrastructure located on the Garching campus are provided
- Gain of expertise in advanced numerical methods

This thesis can be written either in German or English. The potential start date is 1^{st} April.

TUM Contact Person

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