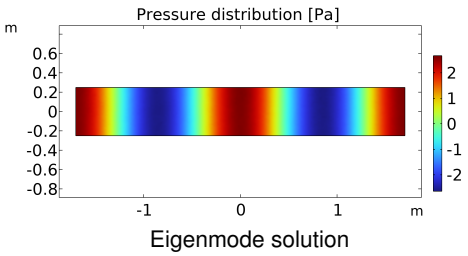
Chair of Vibroacoustics of Vehicles and Machines
TUM School of Engineering and Design
Technical University of Munich

Semester Thesis / Master Thesis / IDP (theoretical/numerical)

Design of a Novel Energy-Based Approach for aeroacoustic application

Topic



Eigenmode solution

In the field of aeroacoustics, displacement-based wave formulations offer a promising framework for modeling sound propagation within compressible background flows. While such formulations are derived from the same conservation equations as the Linearized Euler Equations (LEE), certain key aspects differ. Specifically, a Lagrangian approach is employed to obtain a displacement-based description of the acoustic field. This makes these formulations particularly relevant for applications in fluid-structure interaction and helioseismology.
Despite their potential, the numerical treatment of these aeroacoustic equations presents significant challenges due to the presence of undesired eigenmodes. To address these challenges, novel numerical solution approaches are needed to enhance their solvability across a wide range of engineering applications. This thesis focuses on energy-based methodologies, investigating the conservation of energy in the presence of background flows. Building on the existing knowledge at the chair, the aim is to advance these methods and extend their applicability.

As part of this work, you can focus on the further development of the theoretical foundations, or make use of open-source finite-element-method software to compute the equations in order to prevent unphysical modes.

Possible tasks

- Literature review on existing energy-based approaches solving partial differential equations
- Development of numerical formulations for solving aeroacoustic equation's using the multiphysics software COMSOL
- Develop a custom finite element method (FEM) tool based on open-source software

Requirements

- High interest and knowledge in the area of (aero-) acoustics or computational methods required
- High interest in the area of theoretical analysis and numerical treatment of partial differential equations
- Please provide a short personal cover letter along with 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 start is possible at any time.

TUM Contact Person

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