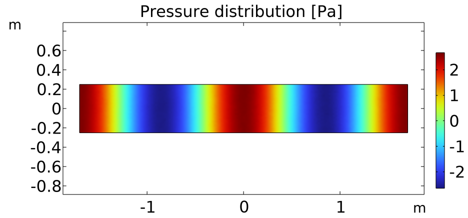
Chair of Vibroacoustics of Vehicles and Machines
TUM School of Engineering and Design
Technical University of Munich

Semester project or master thesis (theoretical/numerical)

Design of a Novel Energy-Based Approach for Solving Galbrun's Equation

Topic

In the field of aeroacoustics, Galbrun's equation offers a promising framework for modeling sound propagation within compressible background flows. While Galbrun's equation is derived from the same conservation equations as the Linearized Euler Equations (LEE), certain key aspects differ. Specifically, a Lagrangian approach is employed to create a displacement-based formulation, rather than pressure fluctuations. Consequently, Galbrun's equation is particularly relevant for applications in fluid-structure interaction and helioseismology.



Eigenmode solution of Galbrun's equation

Despite its potential, the numerical treatment of Galbrun's equation presents significant challenges due to the presence of undesired eigenmodes. To address these challenges, novel numerical solution approaches are needed to enhance the equation's 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.

Tasks

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

Requirements

- High interest in the subject of aeroacoustics and energy-based modeling
- High interest in the area of theoretical analysis and numerical treatment partial differential equations
- Knowledge in acoustics or fluid dynamics is beneficial

Benefits

- Insight into the field of computational acoustics and other fields of engineering
- Availability of workspace and IT infrastructure located on the Garching campus
- Gain of expertise in advanced numerical methods and computational science

This thesis can be written either in German or English. The start is possible at any time.

TUM Contact Person

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