Institute of Fundamentals and
Theory in Electrical Engineering

Masterthesis

Viscou-thermal acoustics on moving domains

Motivation

Due to the requirements of headphones to get more compact and efficient, the demand for highly integrated Micro-Electro-Mechanical Systems (MEMS) speaker solutions is on the rise. The high integration and small scales (sub micro-meter range) poses the requirement to include viscous and possibly thermal effects for the sound propagation. Furthermore, the sound generation principles investigated at our institute require a formulation for moving domains in order to resolve object movement. Therefore, the already existing Arbitrary-Lagrangian-Eulerian (ALE)-framwork for viscous acoustics of our inhouse FEM solver openCFS should be extended to also include thermal effects.

Research Questions

The goal of this thesis is to derive a formulation for thermo-viscous acoustics on moving grids, implement and test it in openCFS. Finally, the new formulation should be used to simulate the operating principle of a new sound generation principle. The focus of this thesis lies on multi-physics and the interaction/coupling of different physical fields (linearized flow, acoustics, thermal).

Tasks

- Derive and verify an ALE formulation for thermo-viscous acoustics
- Implement the missing coupling and ALE-related terms in openCFS (programming language is C++)
- Test the formulation

Organisation

- Language: German/English
- Start: As soon as possible
- Prerequisites: General knowledge of acoustics and vector analysis
- General FEM knowledge is advantageous but not necessary

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