# MASTER'S DISSERTATION AT STRUCTURAL MECHANICS

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# STRUCTURE-ACOUSTIC INTERACTION BETWEEN VEHICLE FLOOR PANELS AND CARPETS

### BACKGROUND

Of great importance when developing a car model is the noise, vibration and harshness (NVH) attributes as they directly affect the user experience and often are seen as an indicator of overall vehicle quality. An attribute that falls within the NVH definition, and that is especially desired and highly valued amongst customers, is low interior-noise levels when the vehicle is in use.

In order to achieve better NVH performance, especially for premium segment cars, noise transmitted into the cabin of the vehicle disturbing the overall user experience, needs to be reduced. The disturbing noise is transmitted into the cabin either through air, called airborne, or as structural vibrations through panels surrounding the cabin, called structure-borne.

Much of the structure-borne interior-noise is suspected to primarily stem from the floor panels of a vehicle. Such floor panels are made of metal covered by interior carpets to dampen the noise radiation. The vibration interaction in such panel-carpet setups has formerly been investigated, why the dynamic behaviour of the coupled system is recognized for critical frequency ranges. However, the structure-acoustic interaction between the panel-carpet setup and the air in the cabin is rather unclear and not researched enough.

### AIM AND OBJECTIVE

Through more accurate predictions of the structure-borne noise, one may establish more informed design decisions regarding the floor-carpet setups, and therefore enhance the NVH performance in vehicles.

The aim of this Master's thesis is to improve the knowledge regarding the structure-acoustic interaction between vehicle floor panels and interior floor carpets. The objective is to analyze and provide a basic understanding of the disturbing noise radiation process from floor panel-carpet setups, and the governing physical phenomena.

### METHODOLOGY

The project will be conducted with use of the finite element (FE) method, and will prepare for potential subsequent experimental verification of the findings. Numerical FE analyses representing the structural and fluid domains for typical floor panel and interior carpet setups will be performed. To gain an insight into the structure-acoustic behaviour of the system, different ways of modelling the structure-acoustic coupling between panels, carpets and air will be investigated. Main focus will be laid on the frequency range critical for structure-borne noise, that is 20-500 Hz.


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