NOISE ABSORPTION IN ASPHALT MIXTURES

M.Sc. Thesis Project

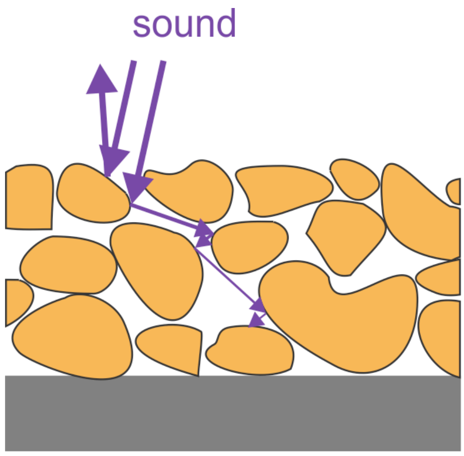
Structural Dynamics and Acoustics (SDA) and Multi Scale Mechanics (MSM)

Goal:

To study the frequency dependent absorption of noise in asphalt roads in relation to the tortuosity/microstructure of the mixture.

Background:

The Netherlands has an extensive asphalt road system, which is used by more than 7 million cars on a daily basis. Asphalt mixtures are composite materials of graded aggregates bound with bitumen plus a certain amount of voids. When looking at asphalt, kinematics at different scales apparently governs the behavior of the material. One of the biggest problems in intensively paved areas is the noise generated by tyre/road interaction and the propagation of noise from the vehicle engine and transmission system. Relevant factors for noise generation and radiation are the texture of the surface, the compound and the degree of porosity of the asphalt mixture.



Plan

1) <u>Experiments on sound transmission and reflection</u>

Do measurements with an impedance tube with p.e. balls (with varying diameter) to find absorption of noise per frequency. Measure bores of asphalt compounds and compare results to schematic models.

2) <u>Numerical simulations with Discrete Element Method (DEM)</u>

To discover the influence of the internal components on wave propagation in a stones-bitumen mixture, different kinds of asphalt will be reproduced using Discrete Element Method and a pulse will be applied. The dependence of the transmitted signal (path, velocity, frequency filtering, etc) on the porosity/structure will be studied. For example, with this procedure, you can look in the sample and tune frequency filtering by modifying the characteristic of the sample.

3) <u>Find noise absorption of asphalt mixtures with impedance model</u>

Use an (analytical) impedance model to describe the noise absorption of asphalt using parameters derived by DEM simulations. Examples of important parameters are: porosity (describing ratio interconnected void volume and total volume), tortuosity (describing non-straight path through pore network) flow resistivity (describing pressure drop due to viscous losses).

The project is part of the Tire-Road Consortium (www.tire-roadconsortium.com) and will be a joint thesis between the group members of the consortium: Construction Management and Engineering (CME), Elastomer Technology and Engineering (ETE), Multi Scale Mechanics (MSM), Structural Dynamics and Acoustics (SDA), Surface Technology and Tribology (STT)

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