

Finite Element modeling of glass-rubber mixtures

B.Sc or M.Sc. Thesis Project

Goal: To study the mechanical behavior of granular mixtures as an engineering application of controlled heterogeneous media by using Abaqus finite element software.

Motivation: Granular mixtures play a significant role in industrial processes; for instance, mixtures of asphalt and concrete have been widely used to construct roads. Exploring and understanding the effects of granular mixture on the physical properties can help in optimizing the amount of asphalt required to make the pavement more robust and enduring. The study of wave propagation allows inferring many fundamental properties of granular materials such as elastic and dissipation mechanisms. A small perturbation is generated on one side of a dense, static packing and its propagation is investigated until it arrives at the opposite side. In this work, wave propagation is studied experimentally and numerically using various mixtures of rubber and glass beads at different confining pressures in order to understand their effect on both stiffness and frequency absorption properties in granular mixtures.

In this study, numerical finite element simulations are conducted to estimate the mechanical behavior of two-phase mixtures of linear and non-linear elastic materials. The numerically observed mechanical response of glass-rubber mixtures is further studied through existing experimental data.

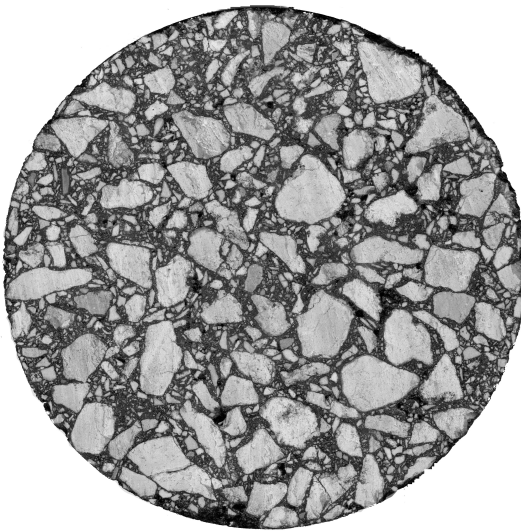


Figure 1: Asphalt is one of the main application of granular mixtures with an interesting mechanical behavior and properties.

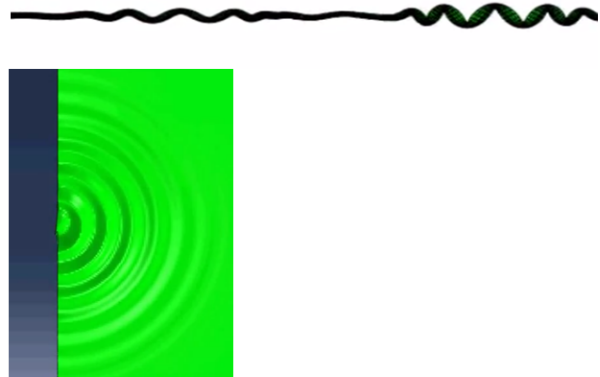


Figure 2: Wave propagation simulation into a solid plate using Abaqus.

Agenda:

- Literature review, research plan and questions
- Introduction to Abaqus
- Modeling of heterogeneous media
- Discussions, presentations and writing thesis (i.e, a scientific paper)

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