STATIK DYNAMIK
PROF. DR. MESCHKE

RUB

Master's Thesis

Computational modeling of Metaconcrete

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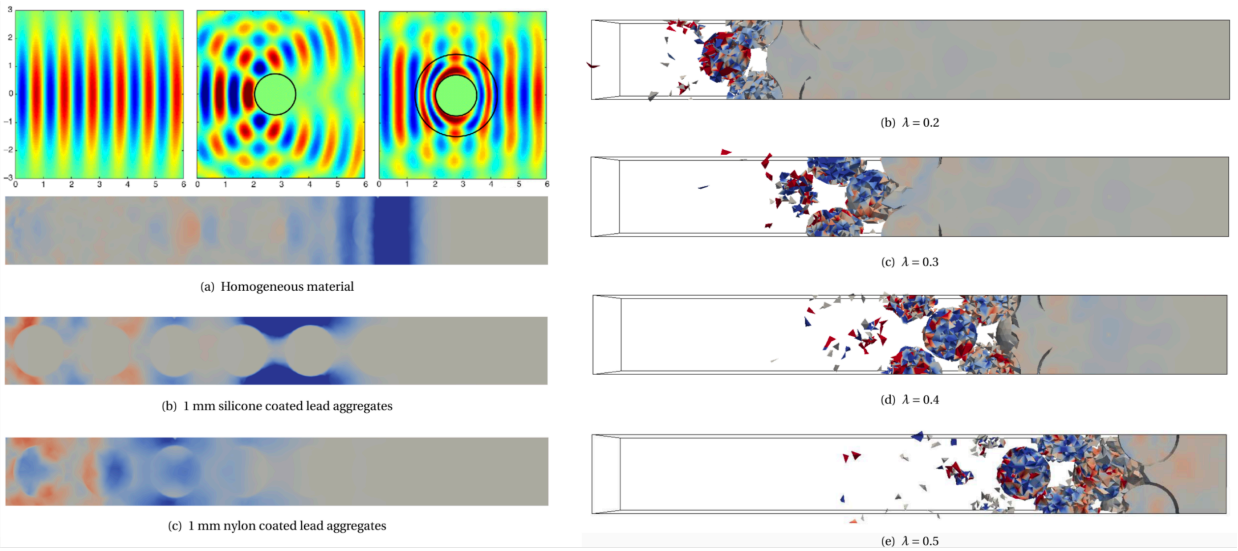

Background: Metaconcrete is a new structural metamaterial with enhanced properties for dynamic loading applications. In this composite material the standard stone and gravel aggregates of regular concrete are replaced with spherical engineered inclusions. Each metaconcrete aggregate has a layered structure, consisting of a heavy core and a thin compliant outer coating. This structure allows for resonance at or near the eigenfrequencies of the inclusions, and the aggregates can be tuned so that resonant oscillations will be activated by particular frequencies of an applied dynamic loading.

Task: Within this thesis the following tasks are to be completed:

- Understanding the wave propagation and attenuation properties of metaconcrete
- Understanding the state-based peridynamic continua and material modeling in it
- Establish a peridynamic computational model for metaconcrete
- Conduct parametric study using the developed model w.r.t. the size and spacing of the metaconcrete aggregates
- Characterize the shielding properties of metaconcrete under high strain rate loading and compare the performance with standard concrete
- Investigate the acoustic cloaking and blast/impact shielding applications of metaconcrete using peridynamics

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