

Institut für Massivbau und Baustofftechnologie Baustoffe und Betonbau MPA Karlsruhe CMM Karlsruhe Prof. Dr.-Ing. Frank Dehn



#### Masterarbeit (MA)

# Lattice element and rigid body spring models for concrete modeling

## Background/Problem:

The mechanical behaviour of composite materials, such as concrete, is a constant topic of investigation. One of the ways to understand this behaviour is through discrete element models (DEMs). Two major DEMs are the Rigid body spring models (RBSM) and lattice element models (LEM). In the first one, the different elements are connected with springs, while in the latter one, it is connected by a network of beams (as shown in Fig. 1 above).

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However, the choice of the properties for these elements, especially (dimension of elements, mechani-

cal properties, failure strength), is uncertain and sometimes decided based on hit and trial. Hence, it is of utmost importance to check the validity of these models by comparing them with benchmark studies and analytical solutions.

### **Objectives:**

RBSM and LEM are already implemented in a Python environment. Hence, the objective of these master's theses would be as follows:

- Conduct a literature review to collect information on the available benchmark studies and analytical solutions.
- Parametrization for the input suitable input parameters for the element dimension and mechanical properties.
- Compare and evaluate the effectiveness of this model for the prediction of elastic modulus, stress distribution, strength, and cracking patterns.

### Learnings and skill development:

- Hands-on experience with the discrete element models used worldwide for concrete analysis.
- Practical application of Python for material modeling, which is directly relevant to the growing field of digital construction.

#### Kontakt

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