Technische Universität Wien
Institut für Mechanik der Werkstoffe und Strukturen

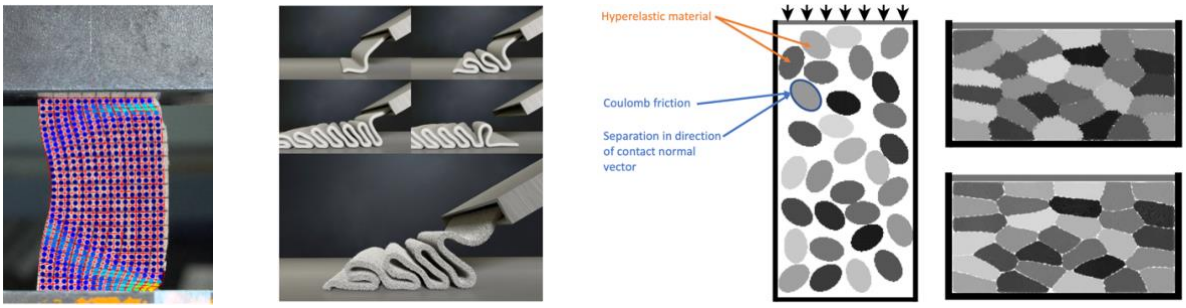
Master's Thesis

Material Point Method in Engineering Simulations

Numerical simulations play a crucial role in engineering. With increasing computational power, new and more sophisticated methods are developed. In the field of continuum mechanics, the finite element method (FEM) is widely used. Though FEM is suited to solve a wide range of engineering problems, other approaches, like the material point method (MPM), provide better solutions for a special class of problems.

In this thesis, the applicability of the MPM should be studied on problems where FEM can be used (small strain, linear elasticity, plasticity, ...) and where the MPM possibly provides better solutions (large strain, viscoelasticity, solid-fluid interactions, ...). The goal is to start with a literature study on the state-of-the-art of the MPM and initially implement a simple model for 2D linear elastic simulations. Subsequently, the model should be extended to cover a broader range of material models, support 3D simulations and simple contact algorithms. The code will be validated using experimental data from the literature.

As the scope of this thesis is quite broad, it can be split into two parts. A bachelor's thesis is suitable for the literature study and the first simple 2D implementation. Building on this work, the model can be extended, broadly tested and validated in a master's thesis. A major part of this thesis is implementing numerical simulation models. Therefore, a good knowledge of Python, Julia or MATLAB is required.



(a) (b) (c)

MPM simulations: (a) wood compression test (b) viscoelastic simulation (c) compression of particles

Supervisor & Team at IMWS:
Sebastian Pech, PostDoc | Markus Lukacevic, PostDoc | Josef Füssl, Professor
contact: sebastian.pech@tuwien.ac.at