

Software Lab:

Modeling:	<input type="checkbox"/>
Mathematics:	<input type="checkbox"/>
Programming:	<input type="checkbox"/>
Science:	<input type="checkbox"/>

FE² for Multiscale Modelling

Description

Advances in additive manufacturing techniques such as 3D printing and selective laser sintering [3] has enabled the creation of engineered multiscale materials such as metamaterials.

For this group of materials, the strong dependency of the macroscale material behavior on the microscale structure prevents the application of conventional continuum formulations of the constitutive equations. One multiscale modeling approach is the FE²-method, a concurrent multiscale technique, where a finite element (FE) simulation of the microscale is solved to find the material behavior for each macroscale integration point [1]. This nested structure captures the effects of microscale geometry on material properties.

This software lab project aims at implementing the FE²-method in an efficient, modular Python package.

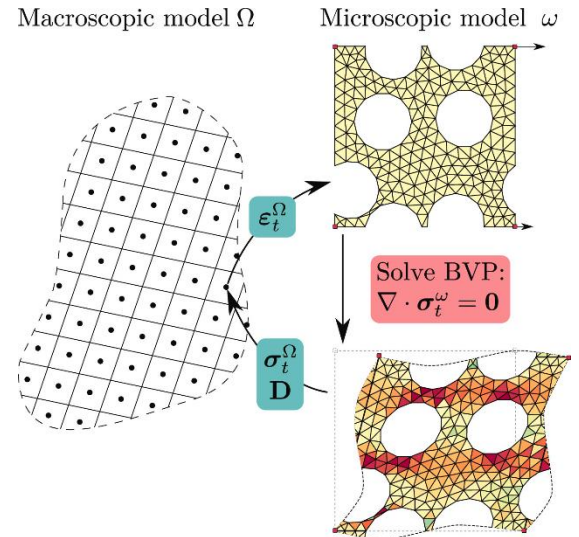


Fig. 1: FE² approach [4]

Task

- **Literature Research:** Research multiscale modeling and FE²-method
- **FE-Solver:** Implement a simple FE-solver in Python
- **FE²-Solver:** Extend the implementation to encompass the FE²-method
- **Code Efficiency:** Speed up the micro-scale FE computations (e.g. parallelization)
- **Application:** Test the framework on a benchmark problem

Supervisor

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References

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