

Announcement – HiWi/ Master’s Thesis

Bone Remodeling in Dental Implants Using Two-Phase Porous Media Theory with Stress-Driven Adaptation

Motivation:



The success of dental implants depends heavily on the mechanical interaction between implant and surrounding bone, which undergoes remodeling in response to applied stresses. Bone can be modeled as a porous medium composed of a deformable solid matrix and interstitial fluid. Using the two-phase Theory of Porous Media (TPM), it is possible to simulate the time-evolving bone density based on stress conditions at the implant interface. This thesis aims to build a first model coupling TPM-based bone mechanics with stress-driven remodeling laws.

Tasks:

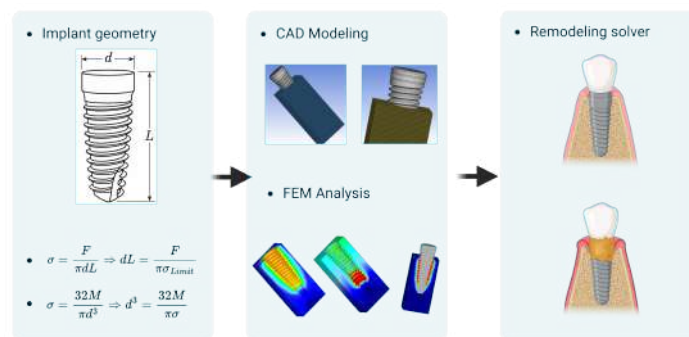
Develop a TPM-based simulation of bone remodeling triggered by mechanical stress from implant-induced loads.

Procedure:

- Formulate a two-phase TPM model.
- Use mechanical stress from FEM simulation (e.g. Abaqus) as boundary input.
- Implement a density update rule based on stress.
- Perform parametric studies to explore effects of implant geometry and loading.

Requirements:

Continuum mechanics or TPM. Programming experience in Python or FEniCS is recommended.



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