Computational Mechanics Group
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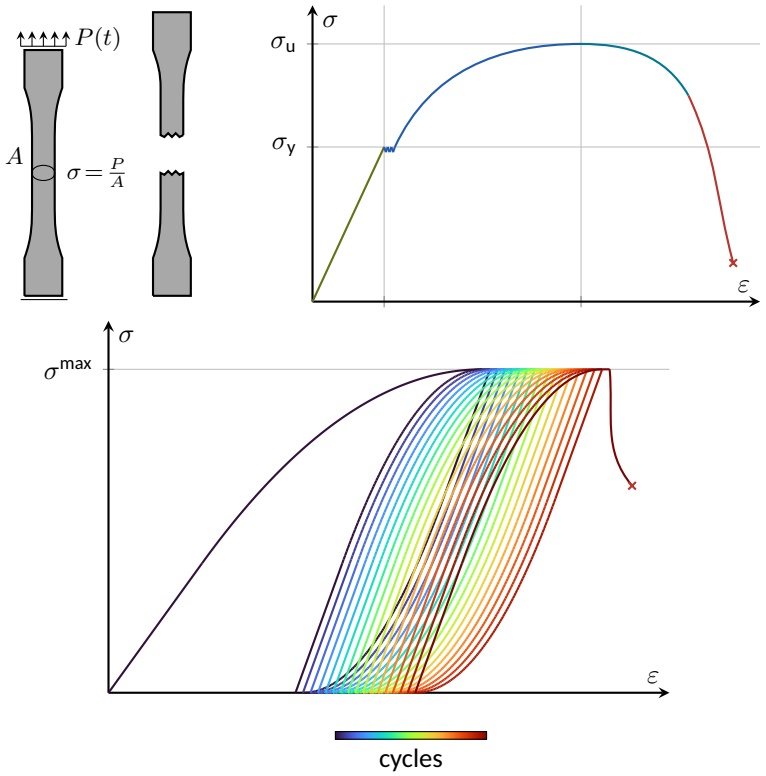
www.compmech.ethz.ch

Master's thesis / Semester project

Phase-field Modeling of Cyclic Plasticity

Altough fatigue is the most common cause for structural failure in real-world applications, it is the least understood theoretically and the hardest to predict due to its wide range of influences. To study it, various computational approaches have been proposed, one of them being the phase-field method for fracture which we want to further develop in that regard. This is due to its very elegant and numerically efficient way of dealing with crack discontinuities by instead approximating them with the phase-field parameter ranging between 0 (intact material) and 1 (broken material). With our ultimate goal of using the phase-field method to study fatigue fracture across different cycle regimes, the modeling of cyclic plasticity in the low cycle fatigue (LCF) regime is essential for an accurate representation of real-world behavior. In this context, the topic of the Master's thesis or semester project is to study ductile fracture in the LCF regime by combining a suitable plasticity model with the phase-field approach. Specifically, we want to implement and compare different plasticity models with respect to their suitability for the phase-field method and LCF. The project offers a lot of flexibility, meaning that the focus can be set on e.g. numerical aspects (acceleration technique, spatial and temporal discretization), mechanical aspects (mean load dependency, influence of the chronology of loadings), experimental aspects (validation, calibrating material parameters) or computational aspects (running the simulations on the high performance cluster of ETH). For the topic, you should have prior knowledge of continuum mechanics and the finite element method, as well as basic coding skills (Python).



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