STRUCTURAL MECHANICS

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Master's Thesis

Numerical Simulations of Steel Anchor Pull-Out Tests in Concrete using Cohesive Zone Model

Supervisors:

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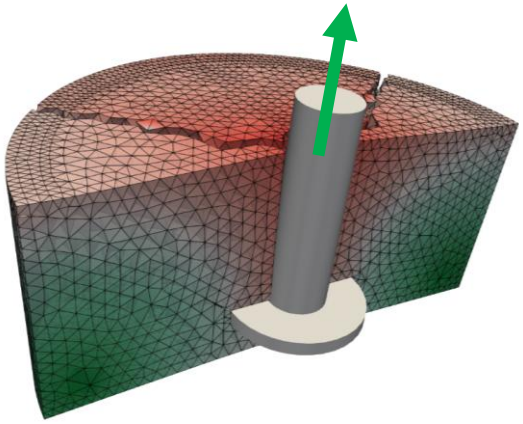
In cooperation with Fischerwerke GmbH

Background:

Steel anchors embedded in concrete are essential components in many structural and industrial applications. Their performance is commonly assessed through a series of experimental tests, with the tension (pull-out) test being one of the most fundamental. While experiments provide valuable insights, numerical simulations offer a powerful way to deepen understanding, optimize design, and reduce testing costs.



Steel anchor pull-out simulation showing cracking behaviour in concrete.

Accurate simulations require robust material models for concrete. One promising approach is the use of cohesive zone models with interface elements, which allow discrete crack representation. The aim of this thesis is to extend the current implementation of the discrete fracture model developed at the Institute of Structure Mechanics and ensure its reliability and applicability to anchor pull-out simulations.

Tasks:

- Review the current numerical model and anchor tension test setup
- Understand the existing cohesive zone model in Kratos Multiphysics
- Extend the current model to enable dynamic explicit simulations
- Implement a Drucker–Prager plasticity model for concrete
- Perform and evaluate simulations of anchor pull-out tests

Expected Contribution:

The thesis will contribute to enabling the modelling framework for concrete–steel anchorage systems. If proved reliable, the framework is to be applied by Fischerwerke GmbH via an ongoing research transfer project.

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