Master's Thesis

in collaboration with
IGTE and IMAT

Global Sensitivity Analysis for Parameter Identifiability in Alloy Design: A Surrogate Modeling Approach

Description

The design and optimization of advanced alloys rely on understanding the complex interplay between processing conditions, microstructure evolution, and material properties. Inverse problems—where optimal processing parameters are inferred from experimental data—are central to this field. However, these problems are often ill-posed due to measurement noise, limited data informativeness, and parameter sensitivity issues. Parameters with negligible influence on model outputs can waste computational resources and reduce the reliability of identification processes.

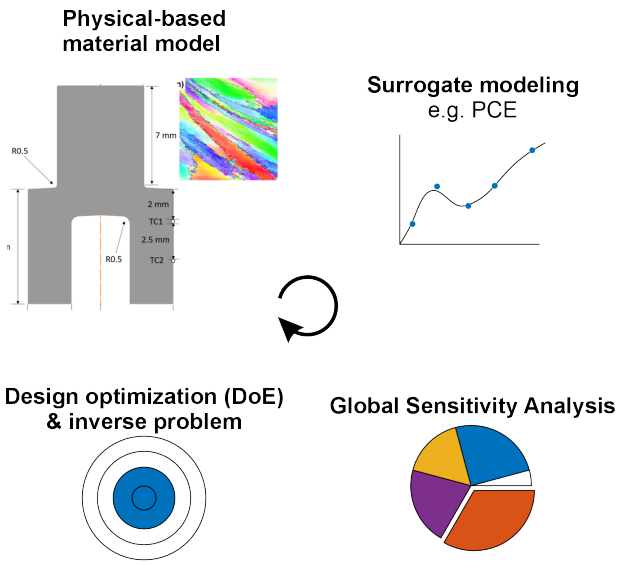
The **SIDODA** project addresses these challenges by integrating Global Sensitivity Analysis (GSA) with model-based optimization. This approach aims to improve parameter identifiability, reduce uncertainty, and streamline the design process by excluding non-influential parameters. Surrogate modeling (e.g., polynomial chaos expansions) is used to accelerate computations and support sensitivity analysis.

This master's thesis will focus on developing and validating surrogate models for a specific alloy system (e.g., titanium or aluminum alloys) and using GSA to assess parameter sensitivity. The goal is to contribute to the SIDODA framework by demonstrating how surrogate models and GSA can enhance the efficiency and robustness of parameter identification in materials science.

Remuneration: Available

Tasks

- Literature review on inverse problems and surrogate modeling
- Preprocess data for surrogate modeling and sensitivity analysis
- Apply GSA to identify (non)influential parameters in the alloy design process



Requirements

- Interest in computational materials science and data-driven modeling
- Basic knowledge in programming

Contacts

Institute of Mechanics - ifm@tugraz.at
Gian Marco Melito - gmelito@tugraz.at