Lehrstuhl für Statik und Dynamik
Prof. Dr. –Ing. R. Wüchner
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Bachelor‘s Thesis:

Implementation and Evaluation of Optimization Algorithms for Improved System Identification

System Identification (SI) aims to adjust numerical models so that their response matches experimental or observed data. The success of SI depends heavily on the performance and robustness of the underlying optimization algorithms used to update model parameters.
This thesis focuses on **implementing and evaluating a range of optimization algorithms** to improve the efficiency and stability of SI. The goal is not only to add new algorithms but also to **compare their performance and convergence behavior** in representative SI problems. The implementations will be tested in a multiphysics simulation framework (KratosMultiphysics), which serves as the computational environment.
Depending on progress, the study may also include **line-search strategies**.

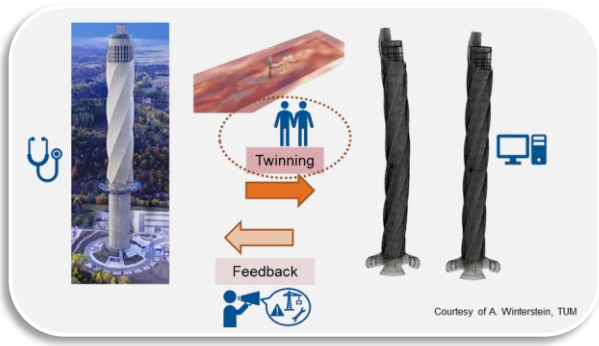
Work Packages

1. **Literature Review:** Study a few advanced optimization algorithms.
2. **Implementation:** of selected advanced optimization algorithms in KratosMultiphysics.
3. **Evaluation:** Compare convergence rates, stability, and solution quality across methods using test cases from System Identification.
4. **(Bonus) Line Search:** Implement and evaluate the performance of line search methods.

Basic knowledge of **Python programming** (preferably through Bau und Umweltinformatik Ergänzung), **numerical methods**, **finite element analysis** (preferably through Statik Ergänzung).

References:

[1] Airaudo, F. N., Löhner, R., Wüchner, R., & Antil, H. (2023). Adjoint-based determination of weaknesses in structures. *Computer Methods in Applied Mechanics and Engineering*, *417*, 116471.
[2] Ansari, T. S. A., Löhner, R., Wüchner, R., Antil, H., Warnakulasuriya, S., Antonau, I., & Airaudo, F. (2025). Adjoint-based recovery of thermal fields from displacement or strain measurements. *Computer Methods in Applied Mechanics and Engineering.*



Supervisor: Talhah Ansari (talhah.ansari@tum.de); Start date: Flexible
Co-Supervisor: Dr.-Ing. Suneth Warnakulasuriya