Modulbezeichnung:	**Introduction to Structural Optimization (ISTOP)**	**5 ECTS**
	(Introduction to Structural Optimization)	
Modulverantwortliche/r:	Fabian Wein	
Lehrende:	Fabian Wein	

Startsemester: WS 2022/2023	Dauer: 1 Semester	Turnus: unregelmäßig
Präsenzzeit: 60 Std.	Eigenstudium: 90 Std.	Sprache: Englisch

Lehrveranstaltungen:

Selected Topics in Structural Optimization (WS 2022/2023, Vorlesung, 4 SWS, Anwesenheitspflicht, Fabian Wein)

Inhalt:

The lecture has two major objectives:

- gaining experience and deeper understanding in solving structural optimization problems
- performing numerical parameter studies via Python scripting

We discuss the theory and application of density-based topology optimization (SIMP), the probably most common structural optimization approach used in industry. The major focus is to gain a deeper understanding of the different aspects of structural optimization (regularization, penalization, mathematical programming) and rating of the results. We also discuss practical impacts (discretization, parametrizing the linear solver) with respect to the corresponding finite element analysis (linear elasticity). To this end we use the academic finite element package openCFS, which becomes open source in winter 2020. It is assumed, that students have a basic background/ understanding in the topics:

- finite element analysis (strong and weak form of partial differential equations)
- linear algebra (direct and iterative solvers)
- basic understanding of gradient based optimization
- programming with Python (no advanced skills required)
- working on the command line (on your own Linux, Apple or Windows computer)

Characteristic for the lecture is a strong focus on homework in form of numerical excercises, i.e. optimization problems to be solved with openCFS. The work load might be higher than for other 5 ECTS lectures, especially with insufficient experience in Python. However really doing the homework individually is essential for the lecture as the didactic concept is to develop core principles in structural optimization by numerical studies in the homework.

In the winter semester 2020, the lecture will be online via Zoom, the pdf slides are provided. openCFS will be provided for Linux, macOS and Windows. In the weekly exercises we discuss questions on the homework via screen sharing from students. As the lecture and exercises are by Zoom only, we can freely shift the schedule. The lecture is in English with oral exam. All further information on StudOn.

Lernziele und Kompetenzen:

- Gaining experience and deeper understanding in solving structural optimization problems.
- Judging complexity of structural optimization problem
- Ability to question designs obtained by structural optimization problem
- Ability to discuss and compare methods within structural optimization problem
- Performing numerical parameter studies via Python scripting.

Studien-/Prüfungsleistungen:

Introduction to Structural Optimization (Prüfungsnummer: 412108)
(englische Bezeichnung: Introduction to Structural Optimization)

 Prüfungsleistung, mündliche Prüfung, Dauer (in Minuten): 30
 Anteil an der Berechnung der Modulnote: 100% Prüfungssprache: Deutsch oder Englisch

 Erstablegung: WS 2022/2023, 1. Wdh.: SS 2023
 1. Prüfer: Fabian Wein