Syllabus

Kursbeschreibung

Titel der Lehrveranstaltung	Elements of modelling for Applied Physics and Engineering Systems
Code der Lehrveranstaltung	46013
Zusätzlicher Titel der Lehrveranstaltung	
Wissenschaftlich-disziplinärer Bereich	IIND-07/B
Sprache	Englisch
Studiengang	Doktoratsstudium in Sustainable Energy and Technologies (Nachhaltige Energie und Technologien)
Andere Studiengänge (gem. Lehrveranstaltung)	
Dozenten/Dozentinnen	Prof. Andrea Gasparella, andrea.gasparella@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/30619
Wissensch. Mitarbeiter/Mitarbeiterin	
Semester	Zweites Semester
Studienjahr/e	1
KP	3
Vorlesungsstunden	20
Laboratoriumsstunden	0
Stunden für individuelles Studium	75
Vorgesehene Sprechzeiten	
Inhaltsangabe	1. mastering the most important concepts about modelling physical systems 2. developing simulation models based on the mathematical description of physical systems

	3. applying the concepts to case studies 4. understanding potential and limitations of simulation for applications
Themen der Lehrveranstaltung	List of topics covered Modeling and simulating: Calculation vs. simulation. Model accuracy. Model validation. Model definition: Definition of model for physical systems. Analytical vs numerical solutions. Model refinement and extension. Finite difference approaches: Solution of partial derivatives differential equations with finite difference approaches. Consistency, stability and convergence. First order schemes (forward, backward). Second order schemes (central, Crank-Nicolson) Applications: Development of case studies. Examples from thermal and thermodynamic systems. Modelling of systems and solutions of control problems.
Stichwörter	
Empfohlene Voraussetzungen	
Propädeutische Lehrveranstaltungen	
Unterrichtsform	Lectures (blackboard and/or slides) and spreadsheet implementation.
Anwesenheitspflicht	Not compulsory
Spezifische Bildungsziele und erwartete Lernergebnisse	(1) Knowledge and understanding: - Modelling and simulation vs calculations - Derivation of models for physical systems - Numerical solutions of differential equations (2) Applying Knowledge and understanding: - Defining models for case studies - Applying simulations to understand system behavior - Calculating multiple performance aspects

	(3) Making judgments: - Comparing different modelling approaches - Deciding the degree of accuracy required for the specific application - Optimizing the design or behavior of a system using modelling approaches (4) Communication skills: - Using the appropriate technical vocabulary related to the topic - Preparing a report representing and summarizing complex results and providing appropriate interpretation (5) Learning skills: - Decomposing a complex problem into sub-problems - Finding the analytical expression and the numerical solution - Comparing different methods and sources
Spezifisches Bildungsziel und erwartete Lernergebnisse (zusätzliche Informationen)	
Art der Prüfung	
Bewertungskriterien	Marks are attributed according to the following assessment aspects: - Synthesis ability to explain the fundamental aspects of the problem (0=nothing, 1=insufficient; 2=sufficient; 3=full) - Analysis ability to describe details and specific formulas/models (0=nothing, 1=insufficient; 2=sufficient; 3=full) - Application ability to implement the principles and formulas and to solve practical cases (0=nothing, 1=insufficient; 2=sufficient; 3=full) - Reporting ability to represent and summarize the main results and to provide an appropriate interpretation
Pflichtliteratur	- Teaching material, handouts, booklets from the reserve collection

Weiterführende Literatur	- Carl-Eric Hagentoft, 2001, Introduction to Building Physics, Professional Pub Service
Weitere Informationen	
Ziele für nachhaltige Entwicklung (SDGs)	Hochwertige Bildung, Maßnahmen zum Klimaschutz, Nachhaltiger Konsum und Produktion, Bezahlbare und saubere Energie