Syllabus

Kursbeschreibung

Titel der Lehrveranstaltung	Finite Element Analysis (FEA)
Code der Lehrveranstaltung	47556
Zusätzlicher Titel der Lehrveranstaltung	
Wissenschaftlich-disziplinärer Bereich	ING-IND/14
Sprache	Englisch
Studiengang	Master in Industrie- und Maschineningenieurwesen
Andere Studiengänge (gem. Lehrveranstaltung)	
Dozenten/Dozentinnen	Prof. Franco Concli, Franco.Concli@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/34279
Wissensch. Mitarbeiter/Mitarbeiterin	
Semester	Zweites Semester
Studienjahr/e	1
KP	5
Vorlesungsstunden	28
Laboratoriumsstunden	18
Stunden für individuelles Studium	79
Vorgesehene Sprechzeiten	
Inhaltsangabe	The course introduces the theoretical background of the Finite Element Method in order to promote a critical and aware approach to its application in in machine design. It also provides exposure practical design cases to encourage understanding of the broader implications of design. The course introduces the finite element method (FEM) for the analysis of solid structural problems. The background of the finite

	element method and its solution procedures for linear analysis will be provided and the different type of elements will be introduced.
Themen der Lehrveranstaltung	• Introduction to FEM: the method of displacements applied to FEM • Formal Procedure For FEM: discretization, Shape functions, displacement, strain, stress, stiffness matrix, solution, recovery of results. • Bar, Simple Beam, 2D and 3D Beam Element. Property and limitations of beam elements • Plane Elements, Plane stress and plane strain, linear and quadratic triangular and quadrilateral elements. Properties and limitations of plane elements • Isoparametric elements. Properties, limitations • Solid Elements, linear and quadratic tet and hex elements. Solid of Revolution. Properties, limitations. • Theory of Plates and Shells. Finite elements for plates and shells • Theory of composite laminate materials. Orthotropy. Finite elements for orthotropic laminated composite materials Nonlinear analyses, contact analysis, large deformation analysis, modal analysis and structural instability analysis will also be addressed. Beside the theoretical part, students will apply the above-mentioned approaches to some simple benchmark at the beginning and to the design of real mechanical components and systems then In particular a practical case study will be developed by the students in the application part and a report will be issued. The report will be object of discussion in the oral exam.
Stichwörter	FEA
Empfohlene Voraussetzungen	None.
Propädeutische Lehrveranstaltungen	
Unterrichtsform	Frontal lectures, exercises, labs, projects, etc.
Anwesenheitspflicht	Recommended
Spezifische Bildungsziele und erwartete	Intended Learning Outcomes (ILO)

Lernergebnisse	By the end of the course, students should be able to: Knowledge and understanding: 1. Know the theoretical bases of the Finite Element Method for the solution of structural problems Applying knowledge and understanding: Know how to apply FEA to practical design cases in the field of stress analysis for machine design. Making judgements: 3. Critically analyze the results of FEA simulation, discuss their accuracy, on the basis of the mesh and elements properties 4. Define a FEM model with a tradeoff between the accuracy and the computational effort Communication skills: 5. Prepare a technical report describing the design application, expose and discuss it at the oral exam Ability to learn: 6. Ability to autonomously extend the knowledge acquired.
Spezifisches Bildungsziel und erwartete Lernergebnisse (zusätzliche Informationen)	
Art der Prüfung	- Formative assessment: In class exercises: 9x120 minutes; ILOs assessed: 2, 3, 4; - Summative assessment: 50% written exam questions; ILOs assessed: 1, 2. 50% report and oral discussion; Quality of the technical report (30%), correctness of the results (20%) Orla discussion (50%); ILOs assessed: 3,4, 5, 6.
Bewertungskriterien	The final mark will be obtained combining the evaluations of the l written test and of the oral examination.
Pflichtliteratur	Lecture notes and documents for exercise will be available on OLE.

Weiterführende Literatur	Olek C Zienkiewicz, Robert L Taylor, J.Z. Zhu, The Finite Element Method: Its Basis and Fundamentals, Seventh Edition (ENG) Robert D. Cook, Finite Element modeling for stress analysis, L Wiley & Sons, 1995 (ENG)
Weitere Informationen	
Ziele für nachhaltige Entwicklung (SDGs)	Industrie, Innovation und Infrastruktur, Hochwertige Bildung