

Syllabus

Kursbeschreibung

Titel der Lehrveranstaltung	Finite Element Analysis (FEA)
Code der Lehrveranstaltung	47556
Zusätzlicher Titel der Lehrveranstaltung	
Wissenschaftlich-disziplinärer Bereich	IIND-03/A
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	<p>The course introduces the theoretical background of the Finite Element Method in order to promote a critical and aware approach to its application in machine design. It also provides exposure practical design cases to encourage understanding of the broader implications of design.</p> <p>The course introduces the finite element method (FEM) for the analysis of solid structural problems. The background of the finite</p>

	<p>element method and its solution procedures for linear analysis will be provided and the different type of elements will be introduced.</p>
Themen der Lehrveranstaltung	<ul style="list-style-type: none"> • 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. <p>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</p> <p>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.</p>
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	<p>By the end of the course, students should be able to:</p> <p>Knowledge and understanding:</p> <ol style="list-style-type: none"> 1. Know the theoretical bases of the Finite Element Method for the solution of structural problems <p>Applying knowledge and understanding:</p> <p>Know how to apply FEA to practical design cases in the field of stress analysis for machine design.</p> <p>Making judgements:</p> <ol style="list-style-type: none"> 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 <p>Communication skills:</p> <ol style="list-style-type: none"> 5. Prepare a technical report describing the design application, expose and discuss it at the oral exam <p>Ability to learn:</p> <ol style="list-style-type: none"> 6. Ability to autonomously extend the knowledge acquired.
Spezifisches Bildungsziel und erwartete Lernergebnisse (zusätzliche Informationen)	
Art der Prüfung	<p>- Formative assessment:</p> <p>In class exercises: 9x120 minutes; ILOs assessed: 2, 3, 4;</p> <p>- Summative assessment:</p> <p>50% written exam questions; ILOs assessed: 1, 2.</p> <p>50% report and oral discussion; Quality of the technical report (30%), correctness of the results (20%) Oral discussion (50%); ILOs assessed: 3,4, 5, 6.</p>
Bewertungskriterien	<p>The final mark will be obtained combining the evaluations of the written test and of the oral examination.</p>
Pfichtliteratur	<p>Lecture notes and documents for exercise will be available on OLE.</p>

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