Variational Calculus and Tensor Analysis

Module-No./Abbreviation	Credits	Workload	Term	Frequency	Duration
CE-WP01/VCTA	5 CP	150 h	1st Sem.	Winter term	1 Semester
Courses Variational Calculus and Tensor Analysis			**Contact hours** 3 SWS (45 h)	**Self-Study** 105 h	**Group Size:** No Restrictions

Prerequisites

Basic knowledge in Mathematics and Mechanics

Learning goals / Competences

The objective of this course is to introduce students to the fundamentals of vector and tensor algebra and its application to continuum mechanics. Moreover, the course will address basic aspects of variational methods in engineering.

After successfully completing the module, the students will be able
- to read, write and interpret tensor expression in index and abstract notation,
- to know and apply tools for formulating and manipulating the equations of continuum mechanics,
- to understand and solve variational problems in mechanics.

Content

Tensor Analysis:
- Vector and tensor notation and algebra
- Coordinates in Euclidean space, change of coordinates
- Differential calculus
- Scalar invariants and spectral analysis
- Isotropic functions

Variational Calculus:
- First variation
- Boundary conditions
- PDEs: Weak and strong form
- Constrained minimization problems, Lagrange multipliers
- Applications to continuum mechanics

Teaching methods / Language

Lecture (2h / week), Exercises (1h / week) / English

Mode of assessment

Written examination (90 min, 100%)

Requirement for the award of credit points

Passed final module examination

Module applicability

MSc. Computational Engineering

Weight of the mark for the final score

5 %

Module coordinator and lecturer(s)

Prof. Dr.-Ing. Johanna Waimann, Dr.-Ing. U. Hoppe

Further information