Variational Calculus and Tensor Analysis
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Module number CE-WP01/SE-O-6/VCTA	Credits 5 CP	Workload 150 h	Semester[s] 3. Sem.	Duration 1 Semester[s]	Group size no limitation
Courses a) Variational Calculus and Tensor Analysis			**Contact hours** a) 3 WLH (45 h)	**Self-study** a) 105 h	**Frequency** a) each winter

Module coordinator and lecturer(s)

Prof. Dr.-Ing. Johanna Waimann

a) Dr.-Ing. Ulrich Hoppe

Admission requirements

Recommended previous knowledge:
Mathematics

Learning outcome, core skills

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.

Contents

a)
- Tensor Analysis: Vector and tensor notation, vector and tensor algebra, dual bases, coordinates in Euclidean space, 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

Educational form / Language

a) Tutorial (1 WLH) / Lecture (2 WLH) / English

Examination methods

• Written exam 'Variational Calculus and Tensor Analysis' (90 min., Part of modul grade 100 %, or Oral Examination (30 Min). Examination Methods will be defined at the beginning of the Semester due to the number of participants)

Requirements for the award of credit points
- Passed final written examination

Module applicability
- M.Sc Computational Engineering
- M.Sc Subsurface Engineering

Weight of the mark for the final score

Percentage of total grade [%] = 5 * 100 * FAK / DIV

FAK: The weighting factors can be taken from the table of contents.

DIV: The values can be taken from the table of contents.

Further Information