INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

Mechanical Design

Structural analysis with the Finite elements method

IDENTIFICATION

CODE :   GCU-3-S2-EC-MAS-2
ECTS :   2.0

HOURS

Lectures :	10.0 h
Seminars :	12.0 h
Laboratory :	8.0 h
Project :	0.0 h
Teacher-student contact :	30.0 h
Personal work :	20.0 h
Total :	50.0 h

ASSESSMENT METHOD

Practical work report
Project report on a numerical discretisation of a structure

TEACHING AIDS

Duplicated documents
Numerical matrix calculation software

TEACHING LANGUAGE

French

CONTACT

M. GRANGE Stephane
stephane.grange@insa-lyon.fr

AIMS

This sheet falls within the Course Unit GCU-S6-STRUCT-2 (Structures - 2) and contributes to:

General Skills in Science for the Engineer:
A1 - Analyze a real or virtual system (or problem) (level 2)
A2 - Operate a model of a real or virtual system (level 2)

Skills specific to the speciality domain :
C7 - Building structure (design, dimension and control a...) (level 1)
C8 - Civil Engineering Structures (design, dimension and control a...) (level 1)

By allowing the student to work and be assessed on the following knowledge:
-determining displacements, strain and stress fields in hyper-static structures made of bars, beams and in 2D systems.
-simulating the mechanical problem in the framework of a numerical computation of balance equations written in weak form.

By allowing the student to work and be assessed on the following abilities:
-developing knowledges about fundamental theory and approximation assumption of displacement field using the principe of virtual power (PV*P)
-solve the discretised weak form using numerical techniques
-apply these tools to bar systems, beam systems and 2D systems

CONTENT

principe of virtual power (PV*P)

Finite element method:
Framework of the method, approximations, finite element families, stiffness matrix and nodal force ; application on bar, beam and 2D systems.

Practical works:
Computation of the stiffness matrix of bar and 2D elements and their assembly in order to solve a structural mechanics problem.

Experimental analysis of a 2D structure by using two methods: strain measurement and digital image correlations method.
Comparison with an analytical approach and a finite element numerical methods.

BIBLIOGRAPHY

Jean-Louis Batoz et Gouri Ghatt. Modélisation des structures par éléments finis. Hermès, 1990.
ZIENKIENWICZ O.C. et TAYLOR R.L. The Finite Element Method, vol. 1 et 2. MCGRAW-HILL, 1991.

PRE-REQUISITE

Initiation to structural analysis
Continuum Solid Mechanics