Analysis of Static and Dynamic Structures

ECTS
4 crédits

Hourly volume
56h

Introducing

Objectives

The student will be expected to understand and be able to explain (main concepts):
- the distribution of internal forces in structures under static mechanical loads (continuous beams, trusses, frames, etc.) and that of the associated stress, strain and displacement fields,
- the dynamic behaviour of discrete and continuous structures,
- The student must be able to: - understand the basic principles of the design process.

The student must be able to
- formulate and justify relevant assumptions for the static resolution of a structure,
- determine the degree of hyperstaticity of a structure,
- The student must be able to: formulate and justify relevant hypotheses for the static resolution of a structure, determine the degree of hyperstaticity of a structure, solve a hyperstatic structure by implementing the method of forces,
- solve a hyperstatic structure using the displacement method,
- argue on the choice of the method of resolution,
- calculate the support reactions of the structure,
- draw diagrams of internal forces (bending moment, shear force, normal force),
- calculate the deformation of the structure (displacements, rotations),
- formulate and justify relevant hypotheses for the dynamic resolution of a structure,
- Put into equations a simple dynamic problem (discrete or continuous system),
- determine the solution of a simple dynamic problem, including dissipative and excited,
- determine the eigenmodes of a dynamic system by solving the associated equations,
- determine the eigenmodes of a dynamical system by implementing the Rayleigh-Ritz method,
- write a clear, fair and synthetic calculation note.

Competences INSA (GC) mobilized :
1.1: Master the mathematical concepts and the calculatory tools of the engineer
1.2 : Master the concepts of physics, mechanics, chemistry, thermodynamics for the engineer
1.3 : Implement rigorous scientific reasoning and develop the capacity for abstraction
4.3 : Manage a group: lead a team, argue and negotiate, communicate in crisis situations
4.6 : Be able to integrate socially in a group to progress together

INSA competences (GC) evaluated :
2.1 : Know, understand and apply the methods of calculation of structures and evaluate or predict their behaviour
2.2 : Know and master the formulation, characteristics and performances of the main materials used
2.4: Know and implement the main procedures, regulations and methods applicable to construction operations
3.1: Formulate and model problems, especially in complex systems
3.2: Solve, in an analytical or systemic way, a problem (decompose, prioritise, mobilise resources)

Necessary prerequisites

- Notions of stresses, strains, displacements, rigid body movements.
- Support conditions.
- Fundamental principle of Statics.
- Integration and derivation of polynomial functions.
- Geometry (calculation of surfaces, centres of gravity, lengths, angles, etc.).
- Characterisation of sections.
- Internal forces: bending moment, normal force, shear force.
- Degree of hyperstaticity.
- Resolution of isostatic structures (calculation of support reactions, internal force diagrams, calculation of the deformation by integration of the moment-curvature relation).
- Fundamental Principle of Dynamics.
- Solving second member differential equations, with constant coefficients and variable second member.

Practical info

Location(s)

📍 Toulouse

Non-contractual information