

Mechanics

Introducing

Description

Analyze structure equilibrium and apply Newton's second law to a system of rigid bodies:

- Model usual mechanical actions as wrenches using screw theory (kinematic joints and external forces)
- Model friction using Coulomb's Law of Friction
- Model the tilting of a plane joint using a mobile point of application for the normal force
- Identify a statically determinate/indeterminate system (number of static unknowns)
- Determine a solving strategy for the second law (systems of interest, external forces, free body diagram, equations to use, solid bodies subjected to only two external forces)
- Calculate the mechanical actions that need to be determined (joints or actuators)
- Validate the stability of a structure (sliding, tilting on a plane, loss of contact)

Determine the absolute or relative velocity and acceleration of a point on a rigid body:

- Interpret the kinematic parameterization of a mechanism
- Describe the velocity vector field that characterizes a body's motion as a twist using screw theory
- Apply velocity addition, velocity field analysis and time derivatives of vectors in rotating frames
- Determine the condition for rolling without slipping at the contact between two bodies
- Solve a 2D kinematics problem graphically (instantaneous axis of rotation, velocity field)

Objectives

Solid mechanics

At the end of this course, you will be able to:

- determine the mechanical loads exerted on rigid bodies (preliminary step to sizing),
- verify the stability conditions of a mechanism (friction, tilting, loss of contact),
- analyze velocities and accelerations in a mechanism (particularly in power transmissions).

Necessary prerequisites

- Reading a kinematic diagram
- Solving systems of algebraic equations
- Trigonometry and projections
- Vectors, scalar and vector products
- Derivatives of composite functions

Évaluation

L'évaluation des acquis d'apprentissage est réalisée en continu tout le long du semestre. En fonction des enseignements, elle peut prendre différentes formes : examen écrit, oral, compte-rendu, rapport écrit, évaluation par les pairs...

Practical info

Location(s)

 Toulouse