

Mechanics

System mechanics 1

IDENTIFICATION

CODE : PC-S3-MS-TF
ECTS : 3.0

HOURS

Lectures : 10.0 h
Seminars : 21.5 h
Laboratory : 0.0 h
Project : 0.0 h
Teacher-student
contact : 31.5 h
Personal work : 39.0 h
Total : 70.5 h

ASSESSMENT METHOD

- 1 Written Tests (WT1 of 1.5 hours)
- 1 Final Test (FT1) of 2 hours.
Average : $(WT1*1.5+FT1*2)/3.5$

TEACHING AIDS

- Lecture notes and presentations
- Exercises book (the same for all
the 2nd year students)

TEACHING LANGUAGE

French

CONTACT

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AIMS

The main objective is to provide the students with the appropriate tools, methods and physical principles in order to characterise the mechanical behaviour of systems of rigid-solids with lumped stiffness and damping. Students will be confronted with realistic problems/situations and guided towards realistic simulations of their environment using simple analytical models. This EC is a part of the UE mechanical systems, environment and production (ME)

It contributes to following school competences in engineer sciences

C1 including C11 [level 2b], C12[2a], C13[2a], C14[2b] ; C2 including C21[2b], C22[1], C24[2a] ; C5 including C52[2a] ; C6 including C61[2b], C62[2b]. It contributes to the transversal competence CT2 including CT24[2a] but also CT21, CT22, CT23, CT31, CT34.

by allowing the student to work and be evaluated on following knowledge and capacities :

KNOW... Co1 : definitions and properties of wrenches ; Co2 : the Statics Fundamental Principle ; Co3 : the different design tools used in kinematics and the calculation of the degree of mobility ; Co4 : the parametrization strategy used in geometry/kinematics and the mathematical conditions associated to each complementary joint ; Co5 : the different formulas for the velocities and accelerations calculations and the graphical associated methods ; Co6 : definitions and properties of the basic movements [translation / rotation] and the kinematical contact study.

BE ABLE TO... Ca1 : characterize a wrench and his central decomposition ; Ca2 : write the statics equations and solve the statics problem analytically or graphically ; Ca3 : write the geometric and kinematic constraint equations by firstly identifying the complementary joint[s] ; Ca4 : determine a velocity analytically or graphically, and compute an acceleration ; Ca5 : write justifications, use adapted and exact scientific terms, and write units.

CONTENT

WRENCH/SCREWS: Introduction and definitions: sliding vectors, system of sliding vectors, vectorial coordinates (sum, moment), scalar invariants, special wrenches/screws, central axis, Delassus theorem on equiprojectivity.

STATICS: Fundamental principle, notion of isolated system, mechanical actions, wrench of mechanical actions associated with classic joints, analytical statics.

KINEMATICS : Location of a free solid, kinematics of particles, frame of reference and frame of expression, kinematics of rigid-solids, kinematic screw, time differentiation of vectors and moving basis formula, acceleration field for rigid solids, fundamental motions.

Geometry and kinematics of joints, frame and parameter definition for mechanisms, constraint equations, mobility, combination of motions.

Contact kinematics, sliding, rolling and pitching, kinematic constraint equations, instant motion of solids.

BIBLIOGRAPHY

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AGATI Mécanique Industrielle Dunod
BEGHIN Cours de mécanique théorique Gauthier-Villar
BELLET Problème de mécanique Cepadues editions
BERKELEY Cours de Physique 1 Armand Colin
BONCOMPAIN Méca. des Syst. Indus. (T2) Dunod
BROSSARD Mécanique Générale Tech. de l'Ingénieur AF4
BROUSSE Cours de mécanique Collection U
BONE Mécanique Générale (crs et ap.) Dunod U
CAZIN Cours de mécanique générale Gauthier-Villar
ROY Mécanique du solide rigide Dunod
LASSIA Cinématique Ellipse
LASSIA-BARD Dynamique Ellipse

PRE-REQUISITE

Vectors and Linear algebra

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