INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

DPT FORMATION INITIALE AUX METIERS DE L'INGENIEUR
FIRST CYCLE
INSA Campus LyonTech
8 allée Lumière - Batiment Louis NEEL - 69621 VILLEURBANNE
Phone 0472438960

Mechanics

System mechanics 2

IDENTIFICATION

CODE :	PC-S4-MS-TF
ECTS :	2.0

HOURS

Lectures :	10.0 h
Seminars :	21.0 h
Laboratory :	0.0 h
Project :	0.0 h
Teacher-student contact :	31.0 h
Personal work :	31.0 h
Total :	62.0 h

ASSESSMENT METHOD

- 1 Written Test (WT3) of 1,5 hour
- 1 Final Test (FT2) of 3 hours.
Average : (WT3+FT2*2)/3

TEACHING AIDS

* lecture notes and presentations
* exercices book (the same for all the 2nd year students)

TEACHING LANGUAGE

French

CONTACT

M. SAULOT Aurelien
aurelien.saulot@insa-lyon.fr

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 Pure Sciences.
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), C54(1), C6 including C61(2b), C62(2b). It contributes to following transversal competences : CT2 including CT24(2a) and also CT21, CT22, CT23, CT31, CT34.
KNOW... Co1 : barycenter formula; definitions, properties and theorems (Huyghens) relative to the inertia matrix ; Co2 : kinetics formulas (kinetics/dynamics wrenches, kinetical energy) ; Co3 : behaviour laws (springs, dampers, imperfect joints) ; Co4 : Fundamental Principle of the Dynamics, strategies of writing the equations of the dynamics (determination of efforts in joints, or movement equations) ; Co5 : the kinetical energy theorem ... and the knowledge described in PC-S3-MG-ACEMP.
BE ABLE TO... Ca1 : find the position of the inertia center of a solid ; Ca2 : identify the form of an inertia matrix, integrate his components, change the reduction point or the base of a matrix ; Ca3 : make a preliminary dynamics analyse, depending on the aim of the study (determine efforts in joints, or write the movement equations) ; Ca4 : write the equations of the dynamics, deduce the real movements equations, linearize them ; Ca5 : write the behaviour laws of an element ; Ca6 : write justifications, use adapted and exact scientifical terms, and write units ... and the skills described in PC-S3-MG-ACEMP.

CONTENT

MASS GEOMETRY : Notion of mass, center of mass and center of inertia of a solid, operator of inertia, moments and products of inertia, Huygens theorem, principal and central frames of inertia, balancing.

KINETICS: Kinetic, dynamic screws and kinetic energy for one isolated solid, for a set of solids.

DYNAMICS: Fundamental principle of Dynamics and General Theorems (vectorial form), classification of Galilean (Newtonian or Inertial) frames depending on the studied phenomena. Force wrench transferred by joints taking into account friction, Coulombs friction (sum and moment), viscous dissipation, rheology of some usual mechanical components, and mechanical actions by actuators. Selection of the sub-system(s) to be isolated depending on the simulation objective(s): equations of motion and/or mechanical actions.
Position of equilibrium, stationary positions and, for systems with a single degree-of mobility, linearized equation of motion and stability.
First order equations, power, work, kinetic energy theorem, force and potential, first order equations derived from kinetic energy

BIBLIOGRAPHY

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

- General mechanics 1
- Vectors and Linear algebra
- Ordinary Differential Equations

INSA LYON
Campus LyonTech La Doua
20, avenue Albert Einstein - 69621 Villeurbanne cedex - France
Phone +33 (0)4 72 43 83 83 - Fax +33 (0)4 72 43 85 00
www.insa-lyon.fr