INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES RENNES

Academic year 2024/2025

Courses offered by the programme

Génie Mécanique et Automatique (GMA)
Mechanical and Control Systems Engineering

Semester(s) :

Curricula are organized in groups of courses (Unités d'Enseignement (UE)), consisting of several courses (Eléments Constitutifs (EC)). An EC is a teaching module including lectures (cours magistraux (CM)), tutorials (travaux dirigés (TD)), laboratory work (travaux pratiques (TP)), projects (PR), conferences (CONF), personal work (TA) and possibly other pedagocial activities (DIV). Some internships (stages (ST)) are compulsory

Commonly used abbreviations
CM : Lectures
TD : Tutorials
TP : Laboratory Work
CONF : Conferences
TA : Personal Work
PR : Project
ST : Internship
DIV : Miscellaneous

Kinematics and Dynamics of Mechanisms	GMA06-CDM
Number of hours : 42.00 h	3.00 ECTS credit
CM : 16.00 h, TD : 10.00 h, TP : 16.00 h	
Reference Teacher(s) : ARAKELYAN Vigen	

Objectives :
Systematic approach to methods and general principles of the study of mechanisms. Calculation of mechanical systems from
given conditions.

Content :
Kinematics and Dynamics of mechanisms
- Structural analysis of mechanisms
- Analysis of the singular positions of mechanisms
- Mechanisms with specific structures (Bennett mechanism, 3D spherical mechanisms with 4 rods, Sarrus mechanism). Kinematic analysis of 3D mechanisms. Method for transformation of coordinates: "Denavit-Hartenberg" method
- Kinematic analysis of closed-chain mechanisms. Cam mechanisms: main laws of motion with their typical characteristics
- Example of a cam fairing with an elastic receptor. Kinematics of articulated mechanisms with gears. Watt mechanism.
- Geometric synthesis of mechanisms. Burmister problem. Synthesis of a polyarticulated mechanism, function generator for
three, four, and five given positions (polynomial method)
- Rough reproduction of a given motion (approximation by quadratic mean-value and the minimisation of the maximum value: Chébichev approximation)
- Synthesis of mechanisms under futher conditions (transmission angle, etc.)
- Newton-Euler equation
- D'Alembert rule and calculation of stress in mechanical bonds: matrix method. Assur groups: Calculation simplification by reduced size matrix.
- Lagrange equation. Examples of industrial systems and applications.
- Equation of motion of single degree of freedom mechanisms (simplified form of the Lagrange equation).
- Momentum: calculation and minimisation. Relief system of elements of a mechanism.

Bibliography :

Requirements :
Linear mapping, matrixes, differential equations, approximation methods (VMQ, Thcebichev, etc).

Organisation :

Evaluation :
Two-hour written examination.
Mark for practical work in the laboratory.

Target :