Summary
The objective of this course is to introduce to the student the basic concepts, models, algorithms and methods for the kinematic and dynamic analysis of multi-body systems, specifically designed for mobility.

Content
This course reviews and reinforces the student’s understanding of kinematics and dynamics of multibody systems. We are going to explore the mechanical machinery that generates motion in biological and engineered systems, from the tiniest microorganisms to airplanes. The emphasis will be on design rules, scaling laws, constitutive equations, computational modeling, and numerical analysis.

Keywords
Constrained multi-body simulation, principles of locomotion, multiphysics, design of machinery, bioinspired engineering

Learning Prerequisites
Important concepts to start the course
- Rigid Body Kinematics and Dynamics
- Numerical Analysis
- Basic programming skills in MATLAB

Learning Outcomes
By the end of the course, the student must be able to:
- Model and analytically solve simple problems of statics and stress analysis, S1
- Analyze and design assemblies of simple mechanical elements in the framework of static and buckling, S2
- Compare the range of validity of different constitutive laws, B7
- Define, describe and apply the basic flow equations, such as the Navier-Stokes equations, AH14

Transversal skills
- Communicate effectively, being understood, including across different languages and cultures.
- Evaluate one’s own performance in the team, receive and respond appropriately to feedback.
- Summarize an article or a technical report.
• Use both general and domain specific IT resources and tools

**Teaching methods**
The course is organised in theoretical sessions and multi-body dynamics modelling to be realised in projects.

**Expected student activities**
Classroom participation, reading assignments, exercises on theoretical concepts, and mini-projects on computational modeling and analysis

**Assessment methods**
Mini-project assignments during the semester (75%) and final written exam (25%).

**Supervision**

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<tr>
<th>Office hours</th>
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<td>Assistants</td>
<td>Yes</td>
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<td>Forum</td>
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**Resources**

**Bibliography**


**Ressources en bibliothèque**

- Design of Machinery / Norton
- Dynamics of Multibody Systems / Shabana