Elastic Modelling of Robots

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<th>Credits: 4</th>
<th>Semester 3 (ECN)</th>
<th>Compulsory: No</th>
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**Format**

- Lectures: 20 h
- Examples: 12 h
- Private study: 68 h

**Lecturer:** S. Briot, S. Caro

**Objectives:**

This course presents techniques for obtaining the elastostatic and elastodynamic models of robots.

**Contents:**

The following topics are treated:

- Overview of the different methods for the elastic modelling of robots
- Static modelling of serial robots with elastic joints
- Identification of the elastic parameters of serial robots: optimal measurement poses, application to advanced industrial operations.
- Static modelling of any robot with both elastic joints and elastic links
- Dynamic modelling of robots with flexible joints: the inverse and direct dynamic problems, computation of natural modes and frequencies.
- Dynamic modelling of flexible serial and tree structure robots: the inverse and direct dynamic problems, computation of natural modes and frequencies.
- Dynamic modelling of flexible parallel robots: the inverse and direct dynamic problems, computation of natural modes and frequencies.

**Practical Work:** Exercises will be set, involving modelling and simulation of robots. Advanced technical papers from recent international conferences will be analysed and reviewed.

**Abilities:** After completing this course, the students will be able to:

- Understand the fundamentals of the mathematical models of flexible robots and their applications in robot design, control and simulation
- Identify the elastic parameters of a serial robot with flexible joints
- Use of the best methods to develop the required models of a given structure,
- Apply the given techniques to other systems such as mobile robots or passenger cars.
- Use the convenient numerical schemes for numerical integration.
- Use modelling, optimization, and signal processing tool boxes software packages (Matlab, Adams).

**Assessment:** 30% continuous assessments, 70% from end of semester examination.

**Recommended texts:**

- S. Caro and S. Briot, lecture notes on “Elastic Modelling of Robots”

**Further readings:**

will be provided during the course