Design of Automatic Machinery

Lecturer:

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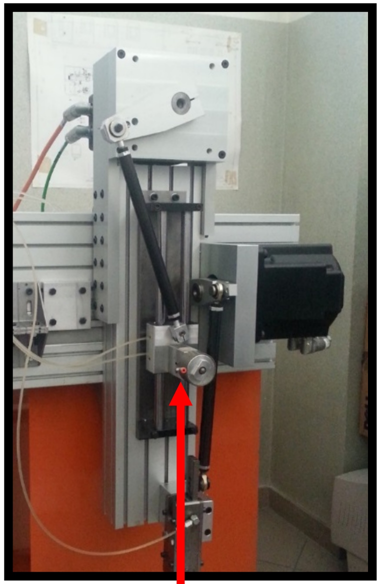
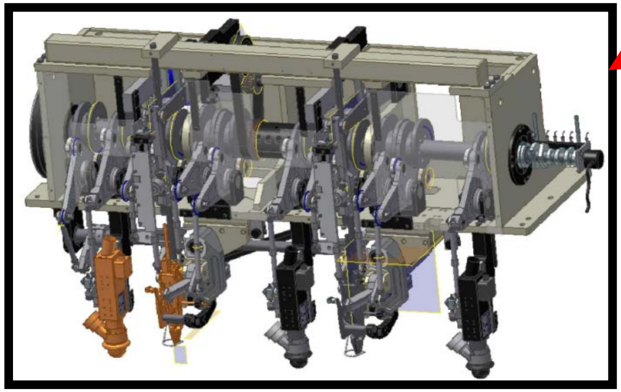
Outline

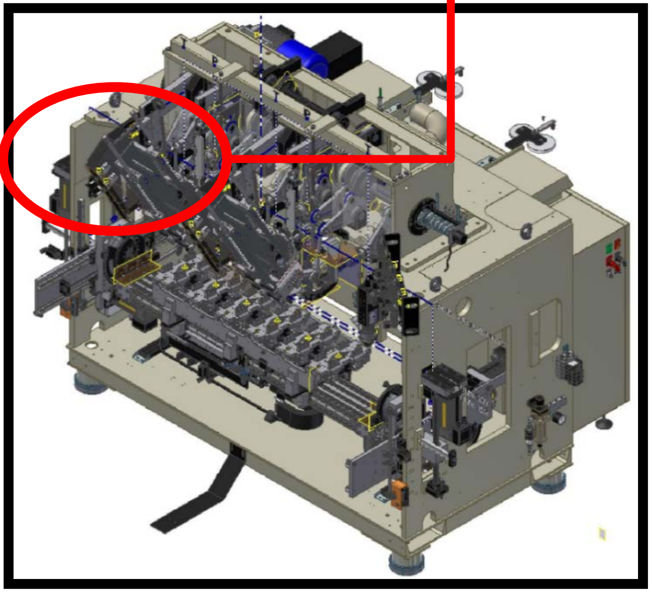
- **Learning outcomes**
  - Course structure (Theory + Lab.)
  - Didactic material

- **Engineering tools**
  - CAD/CAE for the virtual prototyping of automatic machineries

- **Exam: Project-based learning**
  - Industrial case study

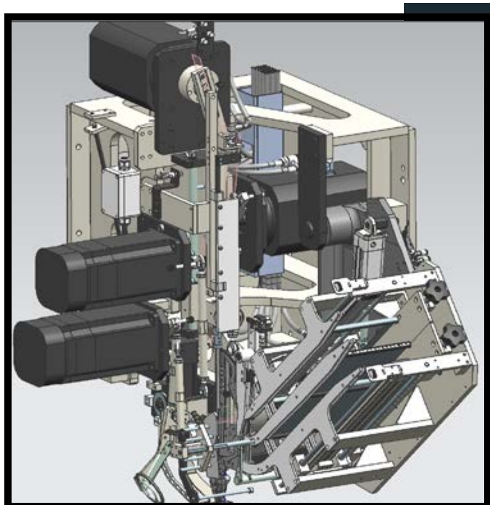


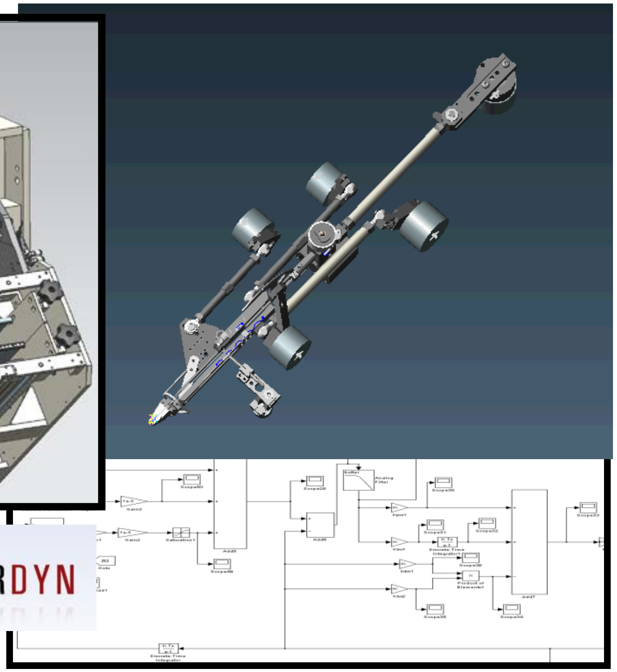


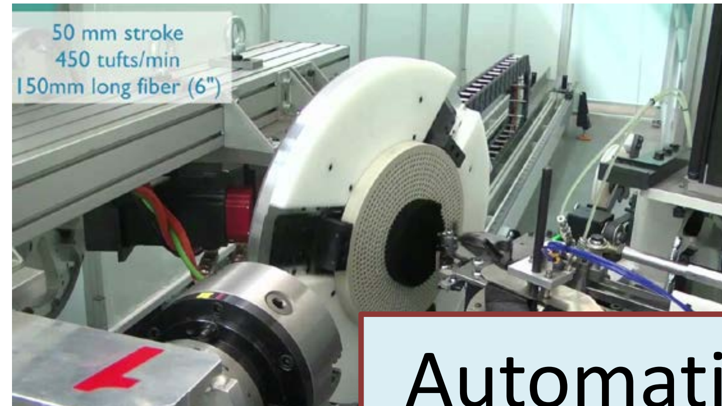


<u>LAB activity:</u> Develop methods and tool for **<u>Virtual Prototyping</u>** of automatic machines

Virtual Prototype ⟷ Physical Prototype







Automatic Machines

- Avoid (when possible) sequential design approaches & **tools which are conceived for particular design problems.**
- **Integrate multi-disciplinary design tools (Also extensive use of the capabilities of commercial software).**

Learning outcomes

"To provide, by means of theoretical concepts and project-based learning, the knowledge of those engineering methods required to develop a project of industrial automation: from functionality identification to the integrated design of both mechanical structure and sensory-actuation subsystem. The course is composed of lectures and lab exercises (by means of a dedicated CAD/CAE software tool)"

- **Interdisciplinary knowledge**
- **Synthesis, rather than analysis**

Generalities

- Machine architecture
- Functional Structure
- Productive parameters

Continuous Machine

Intermittent Machines

Learning outcomes

"To provide, by means of theoretical concepts and project-based learning, the knowledge of those engineering methods required to develop a project of industrial automation: from functionality identification to the integrated design of both mechanical structure and sensory-actuation subsystem. The course is composed of lectures and lab exercises (by means of a dedicated CAD/CAE software tool)"

- **Interdisciplinary knowledge**
- **Synthesis, rather than analysis**

Specific Issues

- **Automatic feeding systems** and related selection criteria
- **Actuation system** and related dimensioning

Selection and sizing of the actuation system

Learning outcomes

Essential Info :

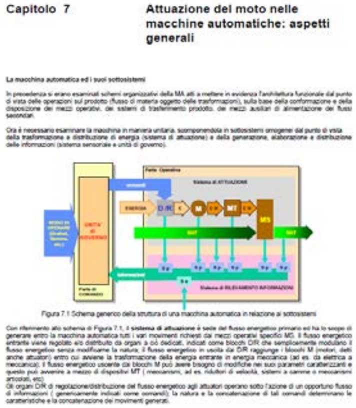
- **6 CFU** (50% theory + 50% lab.)
- LAB: SW for integrated design!
- Continous interaction is welcome …

Exam: **oral exam (3 exercises) + lab. report**

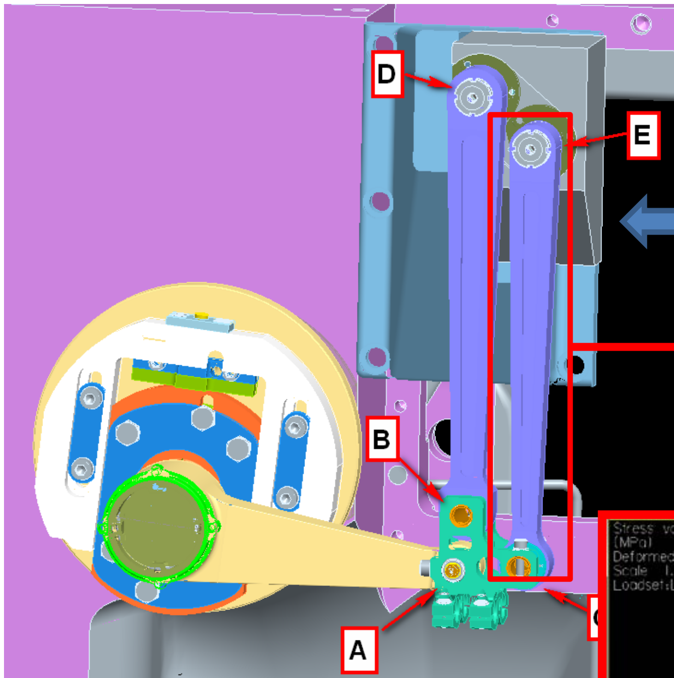
- OK for exams upon request (within the limits of UNI rules)
- Possibility to integrate lab project / thesis
- Possibility for thesis abroad

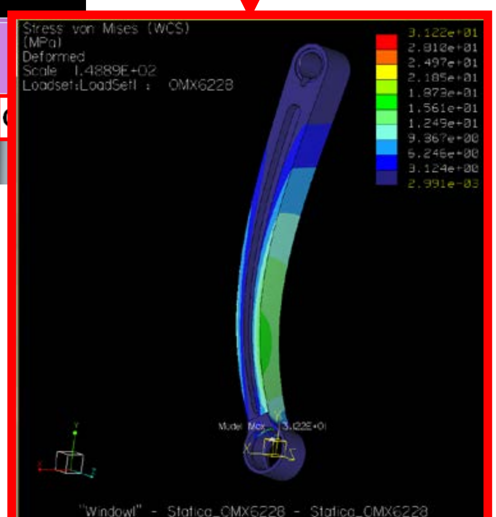
Didactic material:

- **BOOK (under development) is available**
- For advanced CAE: video tutorials are available


Capitolo 7 Attuazione del moto nelle macchine automatiche: aspetti generali

Software tools:
Virtual prototyping tools





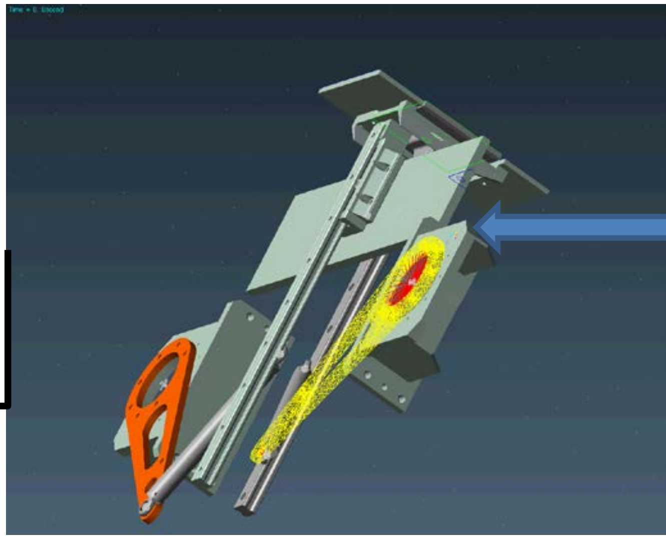
CAD/CAE for integrated design

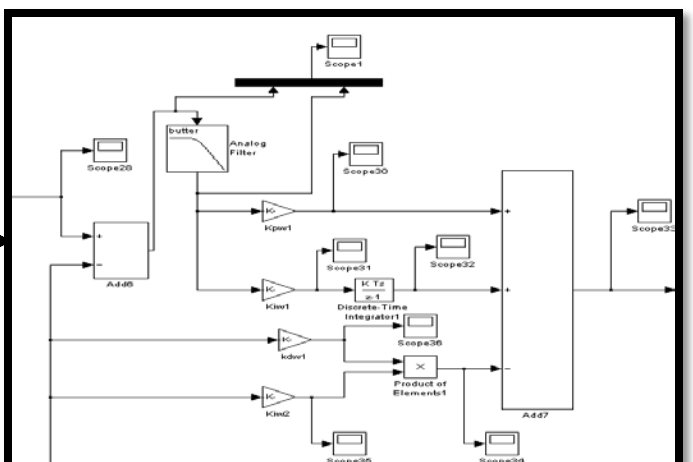
<u>PTC CREO</u>

1. Kineto-Dynamic Analysis/**<u>Optimization</u>**
2. Structural design
3. Sizing of the actuation system

Software tools:

Virtual prototyping tools





CAD/CAE for integrated design

RecurDyn

http://www.functionbay.org/

1. Most advanced Simulation tool for computing motion of complex systems
2. Simulates flexible bodies during motion
3. Embedded structural design/optimization during motion
4. Simulates the actuation and control system (via Matlab integration)

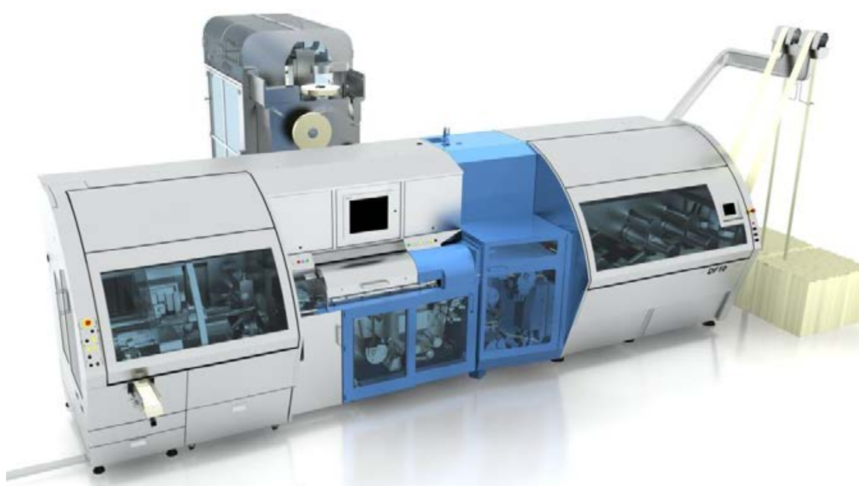
Project-based learning

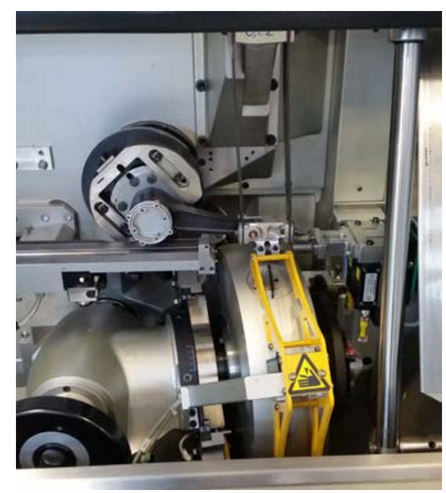
"CASE study taken from industry"

- Design of a sub-group of an automatic machine for packaging
- Solved via CAD/CAE tools, exactly as done in industry

WE WILL START WITH A SEMINAR FROM THE TECHNICAL DIRECTOR OF A MAJOR COMPANY

Speaker: Ing. Fulvio Pastore
G.D Spa - www.gidi.it

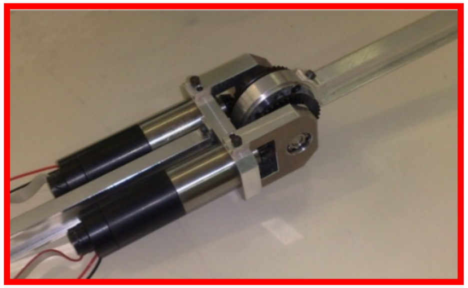




Possibilities for Master Thesis

<u>**Applied research @ Uni Genova or Abroad**</u>

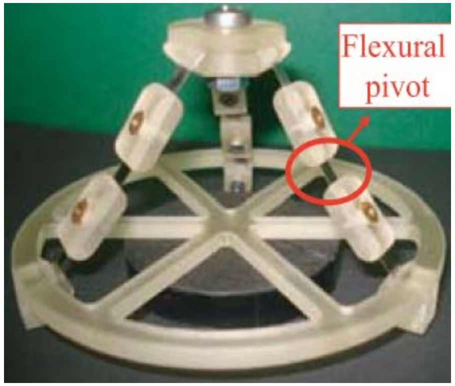
- **Integrated Design of Compliant Mechanisms.**

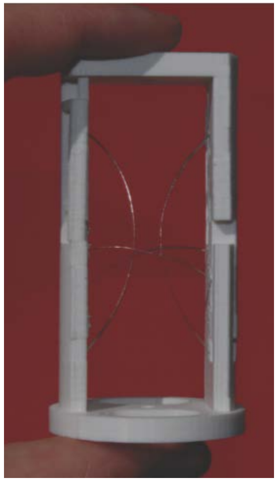


University of Twente
The Netherlands

- **Integrated Design of NON-conventional Actuation Systems.**

MICHIGAN STATE UNIVERSITY





Master Thesis in Medical Robotics

HARVARD MEDICAL SCHOOL

THE SIM Group

www.medicalsim.org