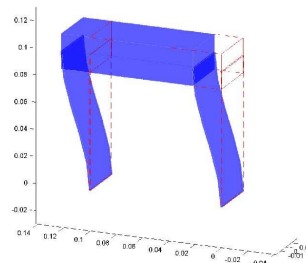
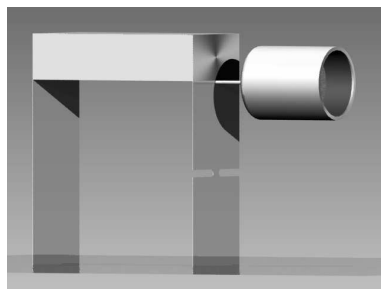


UNIVERSITY OF TWENTE.

Faculty of
Engineering Technology

Mechanical Automation and Mechatronics

Flexible Multibody System Analysis for Control Purposes



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DISC course 2009/2010



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Flexible Multibody System Analysis for Control Purposes

Course overview

Note: Consult the course web site for more and updated information at:

<http://www.wa.ctw.utwente.nl/lectures/FMSA4CP/>

Course material

- This overview.
- Lecture notes (in hardcopy).
- “Prototype modelling of mechanical systems” (in hardcopy).
- SPACAR software manual (in hardcopy).
- Additional papers (download).
- The slides (download).
- Exercises (download).

Introduction

For an introduction you are referred to chapter 1 in “Prototype modelling of mechanical systems” .

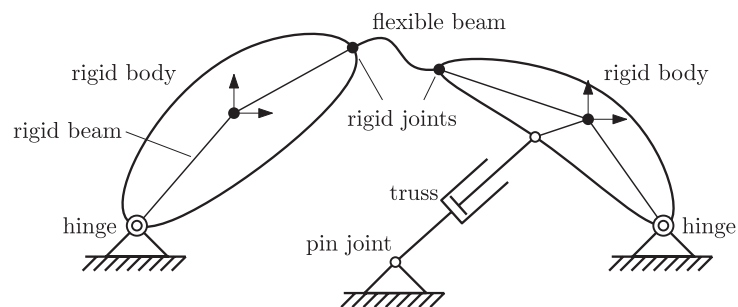


Figure 1: Flexible multibody system.

Course topics and schedule

Week 1: Scope of flexible multibody kinematics and dynamics. Multibody versus finite element formulations.

Weeks 2, 3: Finite element representation of (planar) flexible multibody systems. Kinematical analysis: the concept of constraints, degrees of freedom and geometric transfer functions. Dynamic analysis: lumped mass formulation, consistent mass formulation.

→ **Exercise 1.**

Week 4: Spatial flexible multibody systems. Description of spatial angular orientation: Euler angles, Quaternions.

Week 5: Linearized equations of motion. Simulations with the perturbation analysis.

→ **Exercise 2.**

Week 6: Linearized equations for control system analysis. Linearized state-space equations. Derivation of transfer functions, pole zero cancellation.

Week 7: Modelling for mechatronic design (part 1): Exact constraint design considerations and higher order dynamics. SISO example of an active encoder head.

→ **Exercise 3.**

Week 8: Modelling for mechatronic design (part 2): Control system synthesis. MIMO example of a 2-DOF tilting mirror.

→ **Exercise 4.**

- The SPACAR software packages is introduced during the course.
- More detailed information and updates can be found on the course web page.