

Compliant Motion Systems – Draft Syllabus

Topics by week:

| Week | Topic |
|-------|--|
| 1 | Introduction to Compliant Motion Systems |
| 2 | Mathematical Tools to describe nonlinear behavior |
| 3-4 | Concepts of Stability, Introduction to Lyapunov Theory |
| 5 | Advanced Stability Theory |
| 6 | Concept of Non-Collocation, and Internal Dynamics of Compliant Motion Systems |
| 7 | Flexibility through Lumped Elements - Linear Cases - Feedback Linearization for Non-Linear Cases |
| 8 | Midterm Exam |
| 9 | Command Shaping Techniques |
| 10 | Flexibility through Distributed Elements – Case: Soft Actuators |
| 11-12 | Adaptive Modelling Approaches - Case: Reduced Order Modelling for Distributed Flexibility, Robotic Mechanisms in Space |
| 13 | Backstepping Control - Case: Compressible transmission |
| 14 | Variable Compliance Actuators - Case: Compliance in Human Locomotion |

Recommended Materials:

- Applied Nonlinear Control, Jean-Jacques E. Slotine & Weiping Li
- Handbook of Robotics, 3rd Ed., Ch. 13, Alessandro De Luca, Wayne Book
- Various research articles/materials

Assessment Method:

- Midterm Exam: 30 % - Final Exam: 30 % - Assignments: 40 %

Notes:

- Final Exam will be take-home, and students will be expected to make a presentation about their solutions on the exam date.
- There will be four assignments in total.