Lectures on Motion Planning and Motion Control for Mechanical Systems

Introduction

Anton Shiriaev

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Department of Engineering Cybernetics
Norwegian University of Science and Technology
Trondheim, Norway

Outline

1. Conceptual example

2. What this course is about

3. Time plan/schedule/activities

Conceptual example

Example

Dynamics of a simplified model of a ship is given by

$$m\ddot{x} = F\cos\theta, \quad m\ddot{y} = F\sin\theta, \quad J\ddot{\theta} = T,$$

where

- x, y and θ define the Cartesian coordinates and the orientation of the ship;
- F and T are two control variables (the total force and the torque);
- m and J are the mass and the inertia of the ship.

Task:

Find behaviors of the ship along a straight line

$$y = k \cdot x, \quad \tan\theta = k$$

Example

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Task:

Find behaviors of the ship along a circle of radius r

$$x^2 + y^2 = r^2, \quad \tan\left(\theta - \tfrac{\pi}{2}\right) = \frac{y}{x}$$

What this course is about

Topics

- Tools for analysis of nonlinear dynamical systems
- Modelling (hybrid) mechanical systems
- Representations of a motion of a mechanical system
- Constraints and their representations
- Motion (trajectory) planning for mechanical systems
- Controller design steps for orbital stabilization

- Examples

Time plan/schedule/activities

Tentative time plan for meetings

Lecture 0: September 3, 15:00-17:00

Lecture 1: September 5, 13:00-15:00, homework 1

Lecture 2: September 7, 13:00-15:00

Lecture 3: September 10, 13:00-15:00, homework 2

Lecture 4: September 24, 13:00-15:00, homework 3

Lecture 5: October 1, 13:00-15:00

Lecture 6: October 3, 13:00-15:00, homework 4

Lecture 7: October 5, 13:00-15:00, project assignment

Lecture 8: October 15, 13:00-15:00, homework 5

Lecture 9: October 17, 13:00-15:00

Lecture 10: October 19, 13:00-15:00