

# UE Nonlinear and predictive control



Level  
Baccalaureate  
+5



ECTS  
6 credits



Component  
UFR PhITEM  
(physique,  
ingénierie, terre,  
environnement,  
mécanique)



Semester  
Automne

- > **Teaching language(s):** English
- > **Open to exchange students:** Yes
- > **Code d'export Apogée:** PAX9GIAL

## Presentation

### Description

#### Non linear control (20 h)

1. Introduction to nonlinear systems: representation and specific features
2. Nonlinear systems analysis: stability, tangent linearization, Lyapunov methods
3. State feedback control of nonlinear systems: approximate linearization, exact linearization, backstepping, sliding modes
4. State observers for nonlinear systems: Extended Kalman Filter, Output injection, High gain designs
5. Observer-controller schemes: adaptive methods, output feedback control

#### Predictive control (14 h)

- Predictive control
  - Introduction to constraints
  - Finite horizon predictive control
  - Stability conditions
  - Examples
- Predictive control of nonlinear systems
  - Closed loop stability
  - Control parametrization
  - Optimization tools

- Examples
- Complete case study

*List of examples from Mechatronics:* Inverted pendulum, tilting trains, elastic crane, Boeing aircraft, chain of masses linked through springs, automate-manual transmission (AMT), etc.

Prerequisites: State space and transfer approaches for linear systems, optimisation

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## Course parts

UE Nonlinear and predictive control - CM

Lectures (CM)

34h

**Period :** Semester 9

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## Bibliography

### Non linear control

- "Nonlinear systems", H. Khalil - Prentice-Hall, 2002.
- "Nonlinear control systems", A. Isidori - Springer Verlag, 1995.

## Useful info

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### Place

› Grenoble

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### Campus

› Grenoble - Scientific Polygon