

# UE Adaptive control systems



Level  
Baccalaureate  
+5



ECTS  
3 credits



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



Semester  
Automne

- > **Teaching language(s):** English
- > **Open to exchange students:** Yes
- > **Code d'export Apogée:** PAX9MIAA

## Presentation

### Description

The Adaptive Control course covers fundamental concepts and practical techniques to achieve or maintain a desired level of performance in a control system, especially when the parameters of the plant model are unknown or change over time.

#### Outline :

##### 1. Introduction to the adaptive control

Basic Adaptive Control Configurations, Application examples.

##### 2. Parameter adaptation algorithms

Gradient algorithm, recursive least squares Algorithm, stability of parameter adaptation algorithms.

##### 3. Identification in open loop – a brief review

Data acquisition, model complexity, parameter estimation, model validation.

##### 4. Iterative identification in closed loop and controller redesign



Algorithms for identification in closed loop (CLOE, F-CLOE and AF-CLOE), Validation of models identified in closed loop, Iterative identification in closed loop and controller re-design.

**5. Direct and Indirect Adaptive Control**

Tracking and regulation with independent objectives (known parameters), adaptive tracking and regulation with independent objectives (direct adaptive control), pole placement (known parameters), adaptive pole placement (indirect adaptive control).

**Lab :**

Iterative identification and controller re-design for the Throttle Valve.

## Course parts

CM	Lectures (CM)	18h
TP	Practical work (TP)	12h

**Period :** Semester 9

## Bibliography

- D. Landau, G. Zito "Digital control systems" Springer, London, 2005.
- D. Landau, R. Lozano, M. M'Saad, A. Karimi "Adaptive Control", Springer, London, 2011.
- D. Landau "Adaptive control – the Model reference approach" Dekker, NY, 1979.
- D. Landau ""Identification in closed loop- A powerful design tool (better models, simpler controllers), Control Eng. Practice, no. 1, Jan. 2001.
- D. Landau "From robust control to adaptive control" "Control Eng. Practice, vol. 7, no10, pp1113-1124, 1999.
- Karimi, I.D. Landau "Robust adaptive control of a flexible transmission system using multiple models", IEEE Trans. on CST, March 2000.
- D. Landau, A. Constantinescu, D. Rey "Adaptive narrow band disturbance rejection applied to an active suspension – an internal model approach" Automatica, Vol. 41, n°4, 2005.
- D. Landau, M. Alma, T.A. Airimitoiaie "Adaptive feedforward compensation algorithms for active vibration control with mechanical coupling" Automatica, Vol.47 pp. 2185-2196, 2011.

## Useful info

### Campus

> Grenoble - University campus