UE Adaptive and robust control

ECTS
6 crédits

Composante
UFR Physique, Ingénierie, Terre, Environnement, Mécanique (PhITEM)

Période de l'année
Automne (sept. à dec./janv.)

Diplômes intégrant cet élément

- Master Electronique, énergie électrique, automatique

Langue(s) d'enseignement: Anglais
Ouvert aux étudiants en échange: Oui
Code d'export Apogée: PAX9MIAO

Présentation

Description

The first part of this course offers a modern and practical introduction to **adaptive control**, a powerful set of techniques that **automatically adjust controller parameters in real time** to maintain high performance even when system **dynamics are uncertain or time-varying**. Building on decades of theoretical advances and fueled by today's digital computing capabilities, adaptive control enables engineers to extract meaningful information from **live data** and **continuously refine plant models or controller settings**. Through a unified and coherent presentation, the course guides students from fundamental problem formulation to analytical methods and real-world applications, emphasizing both the mathematical foundations and the practical insight needed to deploy adaptive algorithms effectively. By the end, students will be equipped with the tools and understanding required to design, analyze, and implement adaptive controllers for complex, evolving systems across a wide range of engineering domains.

This course also offers a comprehensive and hands-on exploration of **modern robust control**, with a particular emphasis on **H# methods** and their application to both **SISO and MIMO systems**. Students learn how to analyze and design controllers that **guarantee performance and stability** even in the presence of **disturbances**, **noise**, and model **uncertainties**—an essential skill

for advanced engineering applications. Through a balanced mix of theory, practical methodology, and MATLAB-based examples, the course covers sensitivity functions, robustness margins, uncertainty modeling, and state-of-the-art H# synthesis techniques (Riccati and LMI approaches). By the end of the course, students will be equipped to formulate and solve real-world robust control problems using the general control configuration framework, preparing them for research or industry roles in high-performance and safety-critical systems.

Heures d'enseignement

CMTD	Cours magistral - Travaux dirigés	38h
TP	TP	28h

Bibliographie

Reference textbooks :

- S. Skogestad and I. Postlethwaite, Multivariable Feedback Control: Analysis and Design, 2nd Ed., Wiley, 2007.
- K. Zhou, Essentials of Robust Control, Prentice Hall, New Jersey, 1998.
- I.D. Landau, R. Lozano, M. M'Saad, A. Karimi ``Adaptive Control'', Springer, London, 2011.

Infos pratiques

Campus

Grenoble - Polygone scientifique