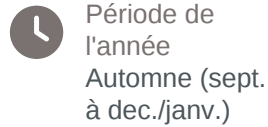
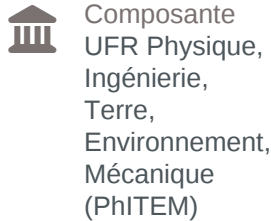
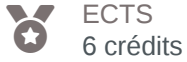


UE Infinite and distributed systems



Diplômes intégrant cet élément

- Master Electronique, énergie électrique, automatique

- › Langue(s) d'enseignement: Anglais
- › Ouvert aux étudiants en échange: Oui
- › Code d'export Apogée: PAX9SCAN

Présentation

Description

The three courses constituting this teaching unit prepare students to control large-scale, complex systems, from infinite-dimensional PDEs to networks of interacting devices. They cover modeling and stabilization of distributed dynamics, advanced optimal and robust control techniques, and distributed algorithms for coordinating large fleets of sensors or robots. Students gain both deep theoretical insights and hands-on skills to design high-performance, resilient, and scalable control solutions.

The first course provides a clear and accessible introduction to the **analysis and control of systems governed by PDEs**. Students revisit essential PDE concepts, discover the power of **semigroup theory** for modeling infinite-dimensional dynamics, and apply these tools to the **control and observation** of key equations such as transport and heat models. The course concludes with the fundamentals of **stability and stabilization**, including Lyapunov methods, giving students a solid foundation for understanding and influencing complex distributed systems.

A concise and powerful introduction to the **optimal and robust control of PDEs** is then provided. Students explore adjoint-based optimal control for parabolic and hyperbolic equations, learn state-feedback design through operator Riccati equations, and discover **H_∞ robust regulation** using game-theoretic methods. Through targeted case studies, the course equips students with practical tools to design high-performance controllers for infinite-dimensional systems.

Distributed Algorithms and Network Systems explores how large networks of simple devices—like sensors or robots—can work together to achieve complex tasks. Students will learn the fundamentals of graph theory, stochastic matrices, and consensus algorithms, a cornerstone of distributed computation. By the end of the course, students will gain both a solid theoretical foundation and practical skills to design and deploy distributed networked systems.

Heures d'enseignement

CM	CM	42h
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Période : Semestre 9

Bibliographie

Reference textbooks :

- J.-M. Coron, "Control and nonlinearity", Mathematical Surveys and Monographs, 136, 2007.
- R. F. Curtain and H. Zwart, "An Introduction to Infinite-Dimensional Linear Systems Theory", vol. 21 of Texts in Applied Mathematics, Springer-Verlag, New York, 1995.
- Z.-H. Luo, B.-Z. Guo, and O. Morgul, "Stability and Stabilization of Infinite Dimensional Systems with Applications", Communications and Control Engineering, Springer-Verlag, London, 1999.
- E. Casas, "Optimal Control of PDEs", http://www1.univ-ag.fr/aoc/pub/gdt/co/Casas_Course.pdf website
- A. Bensoussan and P. Bernhard, "On the standard problem of H_∞-optimal control problems for infinite-dimensional systems", Identification and control in systems governed by PDEs, pp. 117-140, SIAM, Philadelphia (PA), 1993.
- R. Curtain, A.M. Peters and B. Van Keulen, "H_∞-control with state-feedback: the infinite-dimensional case", Journal of Math. Syst. Estim. Control, vol. 3, nb. 1, pp. 1-39, 1993.
- F. Bullo, Lectures on Network Systems. Available on-line: <http://motion.me.ucsb.edu/book-Ins/> webpage, <https://ucsb.app.box.com/v/LecturesNetworkSystems> pdf
- F. Garin, L. Schenato, A survey on distributed estimation and control applications using linear consensus algorithms, in "Networked Control Systems", A. Bemporad, M. Heemels, M. Johansson eds, Springer Lecture Notes in Control and Information

Sciences, vol. 406, Chapter 3, pp. 75-107, Springer, 2011. Available on-line: http://necs.inrialpes.fr/people/garin/WIDEbook_GarinSchenato.pdf

Infos pratiques

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➤ Grenoble

Campus

➤ Grenoble - Polygone scientifique