INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

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Mechatronics and System Control

State-space analysis and tools for optimal and robust control

IDENTIFICATION

CODE : GM-4-S1-EC-MSSC
ECTS : 3.0

HOURS

Lectures :	14.0 h
Seminars :	22.0 h
Laboratory :	8.0 h
Project :	0.0 h
Teacher-student contact :	44.0 h
Personal work :	25.0 h
Total :	69.0 h

ASSESSMENT METHOD

TEACHING AIDS

course document, slides of oral presentation, exercices document

TEACHING LANGUAGE

French

CONTACT

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AIMS

- knowledge:
modeling of dynamical systems, state-space representation, modal analysis, stability, controllability, observability, state feedback, pole placement, output feedback with observer, internal regulator, numerical simulation

Capacities :
- Modeling of multi-physics systems into sub-systems and state variables description
- Analysis of model properties : equilibrium, stability, controllability and observability
- Synthesis of state feedback and output feedback with observer for trajectory tracking and disturbance decoupling
- Linear quadratic optimization pour control design
- Realization of numerical simulation of a control system

CONTENT

- State-space realization : Definitions, systems, equilibrium analysis, linearization
- Analysis of linear systems : time-domain, modal analysis, frequency approach, stability
- Properties of linear systems : Controllability, observability, canonical forms, minimal realization, grammians
- State-feedback and output feedback
- Linear Quadratic Regulator and robustness analysis
- Model reduction

BIBLIOGRAPHY

P. Borne, G. Dauphin-Tanguy, J.P. Richard, F. Rotella, & I. Zambettakis. Automatique: Analyse et régula- tion des processus industriels, Tome 1 Régulation continue. Méthodes et pratiques de l¿ingénieur. Editions Technip, 1993.
E.-K. Boukas. Systèmes asservis. Editions de l¿Ecole Polytechnique de Montréal, 1995.
R. Dorf & R. Bishop. Modern control systems (7th Edition). Addison-Wesley, 1995.
G. C. Goodwin, S. T. Graebe, & M. E. Salgado. Control System Design. Lavoisier, 2000. URL http://csd.newcastle.edu.au/.
L. Jaulin. Représentation d'état pour la modélisation et la commande des systèmes. Lavoisier, 2005.
T. Kailath. Linear systems. Prentice-Hall, Englewood Cliffs, N. J., 1980.
P. De Larminat. Commande des systèmes linéaires. Hermès, 2002.
D. G. Luenberger. Introduction to dynamic systems: Theory, models, and applications. John Wiley & Sons, 1979.

PRE-REQUISITE

3GM-CSL