# *AUTOMATIQUE AVANCÉE*

# ADVANCED CONTROL

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| Lecturers : 16.0 | TC : 0.0 | PW : 0.0 | Autonomy : 0.0 | Study : 12.0 | Project : 0.0 | Language : MI

## Objectives

For increasingly complex systems and increasingly tighter and contradictory performance specifications, the design of a controller achieving the best trade-off between these specifications must be tackled via an optimization problem. In LQ/LQG control, these specifications are recast into a criterion reflecting the trade-off between control performance and its cost. The drawback of this approach is that control performance can only be guaranteed if the model used for the design is an accurate representation of the system. The necessary robustness of the controller can be ensured via H-infinity control, a generalization of classical frequency domain control. These two control approaches will be presented and compared. Examples will allow the students to use

Keywords : LQ/LQG control, H2 control, Robust Control, H-infinity control, multivariable control.

## Programme

The course will start by a recap on classical control methods and classical control performance specifications. We will then present the LQ/LQG control design approach and its generalization i.e. H2 control. Attention will be paid to the additional performance specifications that can be tackled with this specific control design method and to the different ways to achieve this control action (input-output approach or state-feedback with observer structure). Finally, the second advanced control design method (H-infinity control) will be presented. This method allows dealing with similar performance specifications as LQ/LQG control, but can also tackle the robustness issues related to model uncertainty.

## Learning outcomes

- To be able to specify an optimization criterion for LQ/LQG control and for H-infinity control based on a list of performance specifications.
- To be able to design a controller using an advanced control method.
- To be able to analyze the achieved closed-loop system and its control performance.

## Independent study

Objectifs :

Méhodes :

## Core texts

Alazard D., Cumer C., Apkarian P., Gauvrit M. et Ferreres G., *ROBUSTESSE ET COMMANDE OPTIMALE*, Cépaduès editions, 1999
Kwakernaak H. *H2-OPTIMIZATION – THEORY AND APPLICATIONS TO ROBUST CONTROL DESIGN*, Annual Reviews in Control, 26 (1), pp. 45-56, 2002
Skogestad S. and Postlethwaite I. *MULTIVARIABLE FEEDBACK CONTROL, ANALYSIS AND DESIGN*, John Wiley and Sons Chischester, 2005

## Assessment

Final mark = 50% Knowledge +50% Know-how
Knowledge = 100% final exam + 0% continuous assessment
Know-how = 0% final exam + 100% continuous assessment