ENIB/S9 - Control systems

Objectives:
Modern control of linear systems.
Introduction to the study of stability of nonlinear systems.
Introduction to the control of nonlinear systems.
Adaptive estimation.

Requirements:
Analog and digital feedback control system; Basic linear algebra; Calculus; Differential equations; computer science (Scilab).

Key words:
State-variables, modeling, stability, phase plane, Lyapunov, linear an nonlinear feedback control, robustness, estimation, simulation.

Syllabus:
1. Feedback control of linear systems (state-variables representation, stability, controllability, observability, state-variables feedback control, observers, state-variables estimator).
2. Lyapunov stability (basics on the stability of equilibrium, Lyapunov linearization's method, Lyapunov's direct method).
3. Introduction to the identification of control systems.
4. Introduction to the estimation of parameters and noisy signals with algebraic tools.
5. Introduction to robust control based on singular perturbations.
6. Introduction to nonlinear control (linearization, sliding modes, Lyapunov, flatness).

Ressources:
B. Friedland. Control System Design. An introduction to State-Space Methods. Dover Publication. 1986.
J. Lévine Analysis of Nonlinear Systems. A Faltness-based Approach. Springer. 2009.
N. S. Nise, "Control Systems Engineering", 4th Ed., Wiley, 2004.
H. Sira-Ramirez and S. K. Agrawal. Differentially Flat Systems. Marcel Dekker. 2004.
J. J. E Slotine and W. Li. Applied nonlinear control. Prentice-Hall, 1990.