

Signal et Automatique



Component
École Nationale
Supérieure
d'Électrotechnique
d'Électronique

In brief

> **Code:** N6EM02A

Presentation

Objectives

The objective is to acquire tools of the engineer in deterministic signal processing and automatic continuous time, for a first approach of the main aspects related to the mechanical vibrations in an industrial context: the modeling, the measurement, the control. Localized parameter modeling (lumped parameters) is preferred.

Description

The module consists of two parts:

I Modal Experimental Analysis (4 CM, 6TD, 1TP):

- SLI Model Linear Invariant System
- Introduction to the concepts of organization and interaction.
- Frequency Response Function (F.R.F).
- Oscillatory and aperiodic mode. Stability.
- Convolution property. Memory effect.

- Filtering (RIL, RIF).
- Introduction to the signal concept (Fourier analysis)
- Digital identification techniques
- Consequences of temporal truncation (spectral leakage, resolution)
- Time Sampling Effects (Spectral Folding, Shannon's Th.)
- Discrete TF (reciprocal Shannon th)
- TP Modal Experimental Analysis: Modal identification (impact hammer) and detection of defects of a rotating machine (real-time monitoring by Simulink RTW, problem of starting and stopping machine). Resonance and anti-resonance of a 2 ddl system.

II APP Vibrations Under Control (project by team)

- Through Project Based Learning, students acquire basic concepts and knowledge to control a hydromechanical process. The teaching team (5 tutors, one expert) has defined the following learning objectives:
 - The concept of system to represent a physical process.
 - Knowing how to translate the organization (the natural or artificial interactions) of a system by a recursive functional diagram (looped).
 - To be able to translate the phenomena of his specialty, by associations of elementary models: Inertial effect, Resistive, Capacitive.
 - Identify a basic hydromechanical process by analyzing the response to a deterministic solicitation (behavior model)
 - Linearize a nonlinear model around an operating point to obtain a model L.T.I. (Linear Invariant System) in transfer.
 - Determine the stability of a system controlled by the Nyquist criterion.
 - Understand the risks of looped architecture (influence of phase delays on stability).
 - Understand the interest of the looped architecture for performance (for stability, to manage disturbances).
 - Know how to adapt a Proportional controller taking into account the antagonisms between performances (stability / precision, speed / sensitivity to noise). An "agile coach" accompanies teams for project management (SCRUM method).