Systems and Signals

Component
École Nationale Supérieure d'Électrotechnique d'Électronique

In brief

Code ELP: N5AM04A

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 (RII, RIF).
- Introduction to the signal concept (Fourier analysis)
- Digital identification techniques

1. Consequences of temporal truncation (spectral leakage, resolution)
2. Time Sampling Effects (Spectral Folding, Shannon's Th.)

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3. 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 learning objectives are as follows:

- 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).

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