

Bachelor Thesis

Theoretical

Research and application of nonlinearity measures regarding the system dynamics of a spring-mass system under different system conditions

Keywords: nonlinearity measures, nonlinear systems, nonlinear dynamics

Conditions:

Duration: about 12 Weeks (intended duration for bachelor thesis)
 Prerequisites: Basics knowledge of MATLAB and Simulink, good mathematical skills, strong interest in dynamics, shown programming skills
 Language: English or German
 Target Group: Bachelor students (Mechanical Engineering, Wiing, ISE)

Content:

Nonlinear system dynamics is in general a crucial point regarding system identification. The application of nonlinear system identification is more difficult and therefore linear methods are often preferred, also due to their advantages when regarding the design of possible controllers. The decision on considering nonlinear effects can be simplified by using so called nonlinearity measures. These measures attempt to quantify the effects of nonlinear system dynamics to an interpretable number.

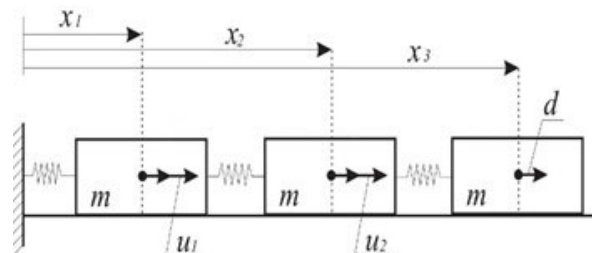


Figure 1: Example of a spring-mass system

The main goal of this theses is to generate an overview of all relevant nonlinearity measures and applying 2-3 of them to a sample system. Therefore, a simple three spring-mass system with modified springs and dampers should be used. A comparison between the different nonlinearity measures should be generated regarding the implementation effort and general usability as well as possible limitations in the application.

The steps in detail are:

- Research and overview of all relevant nonlinearity measures
- Generation of data covering nonlinear dynamics by simulations of a spring-mass system under different conditions (nonlinear behavior of springs)
- Application of at least 2-3 nonlinearity measures on the data analyzing the system nonlinearity
- Comparison of the nonlinearity measures regarding implementation effort and usability
- Detailed documentation and presentation of the results

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