Master thesis

Programming

Modeling and design of a self-adaptive tunable hydraulic valve control system with unknown actuator and process characteristics

Conditions

Duration:	6 Months
Requirements:	Experience in control theory and Matlab programming
Language:	German or English
Target groups:	Master students

Content

In practice, the internal structure or mathematical relationship between inputs and outputs of nonlinear systems is hard to be achieved and the classical control and observer methods for the nonlinear system cannot easily work. Under this condition, black-box models (e.g. Neural Networks) have been applied successfully in the identification and control of nonlinear dynamical systems. In this project, a hydraulic valve system is considered with unknown dynamics. The system is affected by known factors like changes in the temperature or the pressure which will be measured or assumed as constant as well as other unknown factors that can not be measured. The goal is to hold the valve flow rate at the desired value.

The purpose of this thesis is to model and design a self-adaptive tunable hydraulic valve control system using experimental data and considering the mathematical model structure based on the preliminary and known dynamics of the system. The final designed controller should be able to adaptively control the valve flow rate considering the unknown actuator and in the presence of all unknown factors as well as unknown disturbances.

The steps of this project are as follows:

- Understanding of the basic system model (hydraulic valve system) and the details of process characteristics
- Investigating and elaborating of the advanced system model considering the unknown disturbances
- Definition of the control strategy
- Design of a self-adaptive tunable hydraulic valve control system using experimental data
- Validation of the designed model and controller
- Analysis and improvement of results
- Complete and detailed documentation/presentation of the research results

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