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## Bachelor/Master thesis

Programming

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### Neural Network-based Model Predictive Control for a MIMO System using a Structured Control Strategy

#### Conditions

Duration:	4/6 Months
Requirements:	Experience of control theory and Matlab programming
Language:	German or English
Target groups:	Bachelor/Master students

#### Content

In practice, because the internal structure or mathematical relationship between inputs and outputs of a nonlinear system is hard to be achieved, the classical control methods for the nonlinear system cannot easily work. Under this condition, neural networks have been applied very successfully in the identification and control of nonlinear dynamic systems. The universal approximation and prediction capabilities of the multilayer perceptron have made them useful for representing nonlinear models or controllers. In theory, any systems can be approximated by a multilayer neural network, which is generally sufficient with one hidden layer and one output layer.

The purpose of this thesis is to control a MIMO system using a neural network-based model predictive control (NN-MPC), which is based on neural network ability of prediction. With the predictive capability, the possible control inputs will be generated on a given set of rules (controllers) considering conditions and limitations. The realized control input results from the application of a performance measure. The first objective of this thesis is to use different fixed controllers (e.g. funnel controller, PID controller, etc.) considering the performance and computational time in combination with NN-MPC. The second objective is to update the NN model of the system during the implementation (online improvement of the NN model).

The steps of this project are as follows:

- Understanding and analyzing the existing approach and programs
- Implementation of different control structures in combination with NN-MPC
- Investigation and improvement of online training process for NN
- Analysis and improvement of results
- Comparison of the results with the existing approaches
- Complete and detailed documentation/presentation of the research results

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