



Master thesis (ESE/SSE/MSE/MST) in Freiburg and Paderborn

Flight Controller for a Tilt-Rotor VTOL based on Nonlinear Model Predictive Control



Motivation and Task

Advanced Air Mobility (UAM) offers key solutions addressing negative social, economic and ecological consequences of a steadily growing mobility sector. In this area different aircraft configurations exist. Tilt-Rotor Vertical Take-Off and Landing (VTOL) aircrafts are very promising configurations. They do not require additional infrastructure taking off and landing vertically and they are able to travel long distances very efficiently flying like a typical plane. However, a challenge are stabilization and control of their highly nonlinear dynamic characteristics, in particular during the transitions between vertical and horizontal flight. A promising approach for stabilization and control is Nonlinear Model Predictive Control.

The task of this thesis is the development and implementation of a flight controller for a Tiltrotor VTOL based on Nonlinear Model Predictive Control. This includes the following subtasks: (a) literature research, (b) model-based development and testing of a Nonlinear Model Predictive Controller, and (c) Validation of the controller based on real flight tests with an existing prototype at Fraunhofer IEM in Paderborn

Prerequisites: interest and knowledge in control theory, optimization, Matlab/Simulink, optimal control software CasADi and acados.

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