Diffrent Control Strategies Applied On A 3DOF Crane

Student

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Initial Situation: The 3dof crane from quanser was the starting point for this work. First, however, the functionality had to be checked and the whole system had to be controlled with an appropriate system. The real-time machine Speedgoat met all the requirements and was therefore used. Using Matlab/Simulink, a basic programme was then written that controlled the three motors, the 5 encoders and processed the various digital IOs. This then formed the basis from which the various control concepts were developed.

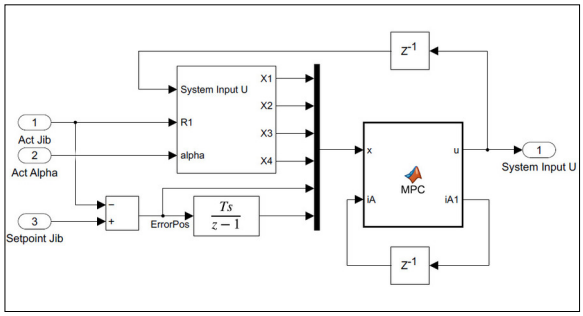
Definition of Task: The aim of this project is to control the system with different control strategies such as state feedback control, model predictive control and PID control. The found controllers should then be compared with each other. However, during the project it was decided to apply the different controllers only to the Jib system. The tower and the rope system are neglected. This decision was made due to time constraints. The focus should be on implementing different control strategies and not on controlling the entire system.

Result: Four different control strategies have been successfully implemented:
State Space controller:
This strategy can follow a reference well, but the inline angle is not well damped.
MPC first approach:
This approach lacks an I-extension and therefore a reference can only be driven with a steady state offset. However, the angle is well damped.
MPC second approach:
With the second MPC approach, a reference can be followed very well and the angle is also well damped.

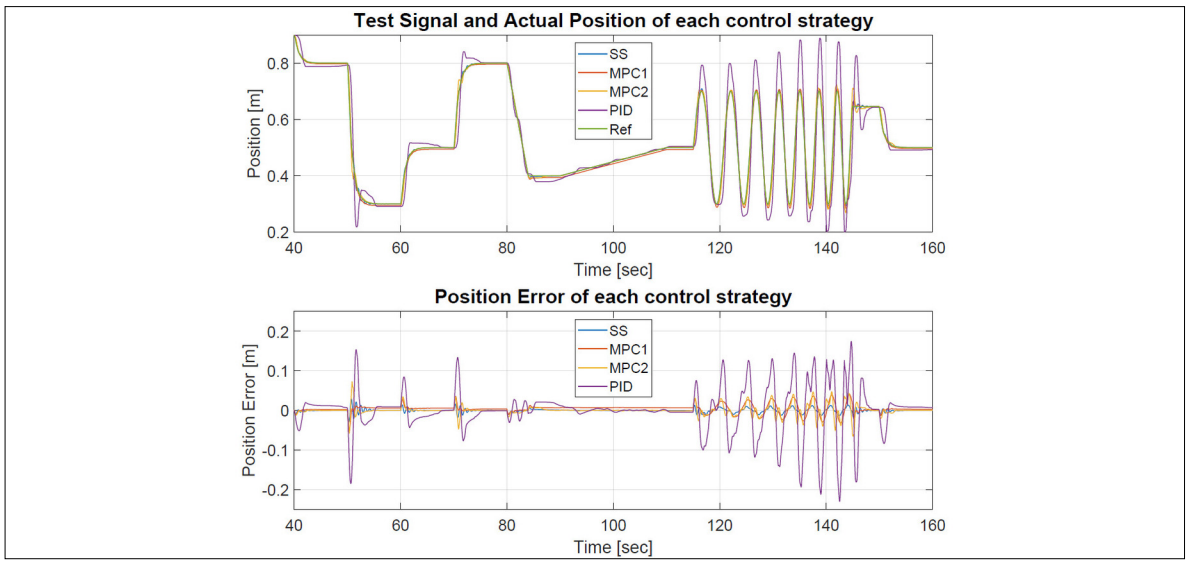
PID:
The PID controller can dampen the angle very well, but following a reference is poor.

3DOF crane from Quanser
http://www.quanser.com/products/3-dofcrane/

MPC controller in Simulink with state observer and I-extension.
Own presentment



Position results of all control strategies (MPC1 = MPC Matlab Designer / MPC2 =MPC ActiveSetSolver).
Own presentment



Examiner
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Subject Area
Sensor, Actuator and Communication Systems, Mechatronics and Automation, Software and Systems