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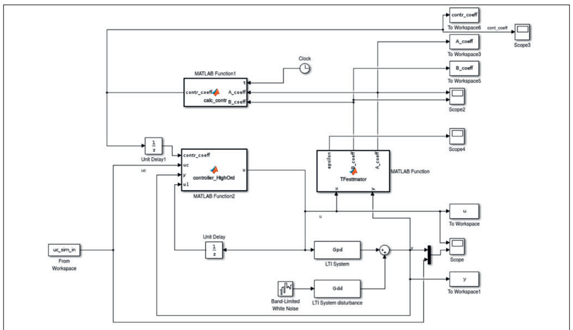
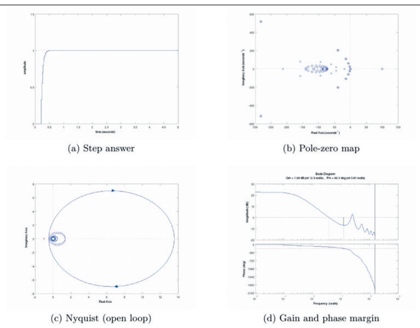
# Rotational speed control for UAV helicopters

## Adaptive control

UAV helicopter as targeted by the task




Simulink model of the STR algorithm




Simulation plots of the final control system

Introduction: The rotational speed of a helicopter's rotor varies significantly depending on the manoeuvres flown. For that reason the rotational speed is controlled with rather simple PID structures, which are sufficient for this task.

Proceeding: To power the helicopters dealt with in this paper a simple combustion engine is used. The dynamics of a particluar engine varies greatly depending on many environmental factors, so the controller needs to be adapted every time the helicopter is started. To simplify this task, a controller structure should be designed that will measure the dynamics of the engine during engine start-up and adjusts the controller to the appropriate values for the flight. Since the controller will be "frozen" before the helicopter takes off, it is not the goal of this task to design a fully adaptive controller that adapts the controller (parameters) during the flight, too.

Result: Several different controller structures based on different approaches have been tested, from traditional approaches to high-end adaptive control algorithms. One particular difficulty in designing the controller has been how to take the dead time of the process into account. Many paper, which have been referred to just ignore the dead time for their adaptive algorithms. The results showed that control algorithms that do take into account the dead time outperform by far the ones that do not. The best results have been achieved by using an STR structure as described by Astrom et al.