Model Predictive Control Tuning for an Unmanned Helicopter Using Particle Swarm Optimization

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Abstract. The study presents a methodology for designing an automatic flight control system for an unmanned rotorcraft by formulating this task as an optimization problem. In the proposed approach, the control system parameters are treated as decision variables and the minimized cost function reflects the performance of the system. This concept can be applied to a wide range of control law formulations. The paper outlines a methodology for designing a Model Predictive Control (MPC)-based system by solving a global optimization problem using the Particle Swarm Optimization algorithm. Unlike classical gradient-based optimization techniques, this approach does not require computation of the cost function gradient, is effective in solving global optimization problems and does not require an initial guess to locate the optimum. The implementation example concerns the ARCHER unmanned helicopter developed at Warsaw University of Technology. Controller tuning was conducted using a linear mathematical model of the system.
