H_∞-Control for Discrete Time Systems

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In this thesis, we consider H_∞-control for discrete time systems. We consider the system which has two inputs and two outputs. The two inputs are the disturbance acting on the system and the control input while the two output are the controlled output and the measurement output. The controlled output is an output of the system whose dependence of the disturbance, we wish to minimize. In H_∞-control we wish to find the control input which stabilizes the system and minimizes the effect of the disturbance on the controlled output.

We adopt a state space approach and make use of max-min quadratic games to solve this problem. We obtain the solution in terms of two Riccati equations which are related to quadratic games. Since we consider general time-varying systems, we are not able to give in the form of necessary and sufficient conditions. However, restricting ourselves to periodic systems, we obtain necessary and sufficient conditions.

As special cases, we also study H_∞-control with state feedback and full information H_∞-control. We give the solutions of these problems in terms of Riccati equations.

Finally as an application, we treat the stabilization of an inverted pendulum positioning system and get H_∞-controllers. We then show experimental results and discuss its robustness.