Robust track-following controller design in hard disk drives based on parameter dependent Lyapunov functions

Richard Conway, Jongeun Choi, Ryozo Nagamune, and Roberto Horowitz

Computer Mechanics Laboratory
Mechanical Engineering
University of California, Berkeley, CA, USA

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Abstract:
This paper presents a novel technique for designing robust track-following output-feedback controllers in hard disk drives (HDDs). In this paper, the manufacturing variations of HDDs are modeled as polytopic parametric uncertainties in linear time-invariant discrete-time systems. For this model, the robust track-following control problem is formulated as the worst-case H2 performance optimization. The optimization problem reduces to the one with bilinear matrix inequalities (BMIs), using the parameter dependent Lyapunov functions and the extended LMI condition introduced by de Oliveira. Although the formulated problem is nonconvex, and thus it is difficult to ensure global optimality, a numerical technique called “G-K iteration” is applied for optimization to guarantee monotonic nonincrease of the worst-case performance during iterations. The proposed design technique will be useful in improving the track-following performance, and thus increasing the storage capacity of HDDs.