Seminar on Control Theory at Fukuoka

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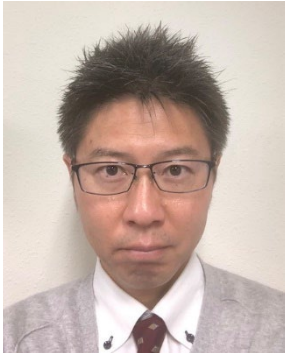
15:30-16:30

Exploring Robust Structured Static Output Feedback Design

Dimitri Peaucelle (LAAS-CNRS, France)

Abstract: Many design problems in control can be recast as the search for static structured (diagonal) output-feedback gains stabilizing an augmented and rearranged dynamical plant model. Moreover, in first approximation that plant may be considered as linear, or at least, one will usually request the linearized plant to be stable before considering the more complicated non-linear version. Because of the approximations leading to the linearized version, the plant parameters are usually uncertain and time-varying. In the presentation we discuss the possibility to design such static diagonal output-feedback gains for uncertain linear systems using a recently proposed matrix inequality based formulation. As expected for this hard problem, the methodology does not provide a guaranteed to succeed result, but provides some interesting promising paths for an efficient algorithm. If we have time we also mention an adaptive control strategy for updating (learning) the structured static gains.

16:30-17:30



L_{p+} Induced Norm Analysis of Linear Systems

Yoshio Ebihara (Kyushu University, Japan)

Abstract:

In this talk, we focus on the L_p $(p \in [1,\infty), p = \infty)$ induced norms of continuous-time LTI systems where input signals are restricted to be nonnegative. This induced norm, called the L_{p+} induced norm, is particularly useful for the stability analysis of nonlinear feedback systems constructed from linear systems and static nonlinearities where the nonlinearities provide only nonnegative signals for the case $p = 2$. We first revisit our methods for upper bound computation of the L_{2+} induced norm using copositive programming. To have deeper understanding on the L_{p+} induced norm, we next analyze the lower bounds of L_{p+} induced norm with respect to the standard L_p induced norm. As the main result, we show that the L_{p+} induced norm of an LTI system cannot be smaller than the L_p induced norm scaled by $2^{\frac{1-p}{p}}$ for $p \in [1,\infty)$ (scaled by 2^{-1} for $p = \infty$). On the other hand, in the case where $p = 2$, we further propose a method to compute better (larger) lower bounds for single-input systems via reduction of the lower bound analysis problem into a semi-infinite programming problem. The effectiveness of the lower bound computation method, together with an upper bound computation method proposed in our preceding studies, is illustrated by numerical examples.