Fixed-interval smoothing in H2 and H1 settings

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A general estimation problem can be formulated as the problem of finding a stable estimator $K$ that makes the estimation error $G_1 K G_2$ stable and “small.” Here $G_1$ and $G_2$ are given generators of the signal to be estimated and the measurement, respectively. Depending on causality constraints imposed on $K$, the estimation problem can be divided into three categories: filtering (causal $K$), prediction (delayed $K$), and smoothing (noncausal $K$). The smoothing formulation corresponds to the case when some amount of delay (called the smoothing lag) between the measurement and the estimation can be tolerated (reasonable in many signal processing formulations).

In this talk the smoothing problem will be addressed in the deterministic setting, when the smallness of the estimation error is measured by either $H_2$ or $H_1$ system norm. Elementary frequency-domain solutions will be derived and their properties will be discussed. In particular, I'll emphasize the dependence of the achievable performance on the smoothing lag. The talk is based on joint work with Gilead Tadmor.