Data-Based Refinements of Parametric Uncertainty Descriptions

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We consider uncertain dynamical systems modeled in terms of linear fractional representations involving constant parametric and other, potentially time-varying, uncertainties. We demonstrate how to exploit available input-state or input-output data of the uncertain system in order to learn refined box constraints for the constant parametric uncertainties that are consistent with the observed data. In contrast to other related approaches, such as [3, 1, 2] that do not or cannot deal with time-varying uncertainties, our approach is of iterative nature and does not rely on lifting the underlying system along the full horizon of gathered data. Moreover, it can be viewed as a preprocessor since the resulting refined box constraints can be utilized to facilitate any subsequent robust (data-based) analysis or controller design. The learning capabilities of our approach are sketched in the figure below.

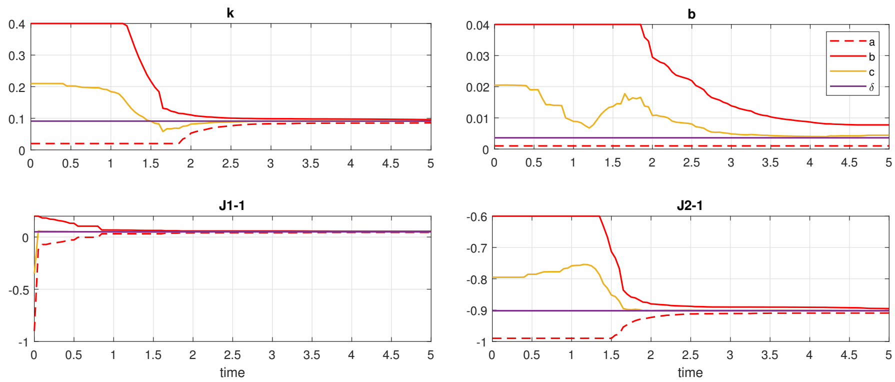

Figure 1: Lower bounds a, upper bounds b and centers c as generated by our algorithm, depicted together with to-be-learned parameter values $\delta \in \{\mathbf{k}, \mathbf{b}, \mathbf{J1-1}, \mathbf{J2-1}\}$ on a numerical example.

References

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