Data-driven interpolation of dynamical systems with after-effect

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Simulation of complex physical, chemical or biological processes described by mathematical models is a standard tool in research and industry. Besides the computational cost for solving high fidelity models, it might even be challenging to develop the underlying dynamical system due to its complex nature. Data-driven model order reduction is a promising approach to construct low-dimensional models directly from measurements. The rate of change of realistic models often depends not only on the current time point, but also on the configuration at previous time instances and we wish to preserve this delay structure in the reduced model.

In this talk, we present a data-driven realization methodology for descriptor systems with retarded argument and unknown delay, which is a generalization of the Loewner framework [1]. This is accomplished by using ideas from moment matching. The realization is obtained with low computational cost directly from measured data of the transfer function. The internal delay is estimated by solving a least-square optimization over some sample data. Our approach is validated by numerical examples, which indicate the need for preserving the delay structure in the reduced model.

References

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