Rational interpolation and model order reduction for data-driven controller design

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In many control applications, a mathematical description of the system, derived from physical laws, is not available. In this case, the controller has to be designed on the basis of experimental measurements. This work presents a data-driven control strategy based on the Loewner framework, where a reduced-order controller is directly obtained from the available experimental data. Rational interpolation is also used to build achievable specifications and to ensure closed-loop stability for the controlled system. No parametric model of the system is used, allowing to handle applications in which the model of the system might be too complicated or too difficult to obtain for traditional model-based strategies. This technique is particularly appealing to control infinite dimensional systems, such as the ones described by linear partial differential equations. Such an example, a crystallizer (common in the chemical industry), is tackled in this work.