

When is a model good enough for control?

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Abstract:

Engineers often use models as proxy for real systems to validate their new control strategies. A good model should describe the physical phenomena in a system, as well as enable the engineers to devise a control strategy that satisfies their requirements. Typically, model-based control uses linear models of systems in real-life applications. Linear models represent a system in a simplified way, typically with low fidelity. It is known that insufficient model fidelity in control applications can lead to low performance of the controller. There is little analysis of if and how control and optimisation algorithms can compensate for the low fidelity. Control approaches for nonlinear systems are usually restricted to selected groups of systems or types of controller with limited analysis of numerical aspects. The main question is how the choice and the fidelity of proxy models affect the operation and how a controller can adjust to possible lack of fidelity. A case study of optimisation of operation of a compressor station subject to degradation will show the impact of model fidelity on control. Application of semi-infinite optimisation methods to a hovercraft example will show the challenges related to robust control as a way of compensating for model uncertainty.