Dynamic mode decomposition with control for robotic manipulator tasks

TECHNISCHE UNIVERSITÄT DARMSTADT

Bachelor‘s Thesis

Control and analysis of robotic manipulators can often benefit from quantitative models. Typically, these models are identified using first principal approaches which account for the entire state and input space of the system. An alternative are purely data-driven methods. Here, we collect large amounts of input-output data and fit a universal function approximator to the data. Both approaches can produce rich models. However, these models are also highly nonlinear, and we are not always interested in such large-scale models. For specific tasks, smaller local models can be a sufficient system representation. Take for example a robotic manipulator that performs a writing task on a very small surface area. In these situations, a local, potentially, linear model is detailed enough.

Dynamic mode decomposition with control is a data-driven system identification technique that allows for identifying linear state-space models. These models have the advantage that they can be efficiently used for system analysis and control design.

Your task will be to generate input-output data for a specific robotic task and identify one or multiple local models using dynamic mode decomposition. Furthermore, you will analyze the quality of the model as well as its suitability for control design.

[1] http://robotics.caltech.edu/wiki/images/9/98/DMDwithControl.pdf

Requirements:

- Fundamental knowledge linear algebra
- Python or MATLAB

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