

MLS model reduction for second-order time-invariant dynamical systems

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Abstract

Time-invariant dynamical systems play an important role in the modelling of physical processes. Particularly, a variety of problems lead to second-order systems. Very often necessary discretizations yield large systems. In general it is required to reduce the complexity of such systems by dimension reduction techniques for numerical treatment. Additionally, it is desirable to preserve the second-order structure of the system. Hence, special reduction methods for second-order systems have been developed. Nevertheless the applicability of the methods to very large systems is often limited.

Multi-level substructuring (MLS) is a hierarchical substructuring concept for the decomposition of huge systems into several smaller systems. In the symmetric case it can be seen as an orthogonal decomposition of the state space. Using this framework it is possible to apply the second-order methods to the smaller subsystems to reduce the dimension of the overall system.

We present a way to apply multi-level substructuring to second-order systems which turns out to be strongly connected to the application of MLS to first-order systems. Furthermore we discuss the error due to the MLS framework and show numerical examples.

Keywords

Model reduction, Multi-level substructuring, Second-order systems.

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