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## AFAS – adaptive fast approximate simulation for non-linear model reduction

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**Abstract:** In this work, we examine the problem of selecting linearisation points for trajectory piecewise linear (TPWL) approximation of non-linear dynamical systems. Linearisation point selection is a crucial step in the TPWL process, the quality and complexity of the approximation rests on it. In contrast to the popular approaches wherein linearisations are done at constant, pre-selected Euclidean distances in the state-space, we propose a new and simple error measure that helps in assessing the linearisation point requirement at different points on the non-linear system trajectory. Based on this error measure a new scheme to simulate the non-linear system, create linearisations at viable points and obtain a better TPWL approximation is presented. Finally, we substantiate our observations and propositions by detailed numerical tests on two non-linear circuits.

**Keywords:** large dynamical systems; model order reduction; MOR; non-linear systems; simulation; approximate simulation; modelling; trajectory piecewise linear; TPWL; linearisation point selection; trajectory sampling; error analysis.

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