Model Order Reduction of Large Nonlinear Electric Circuits via the Trajectory Piecewise-Linear Approach

J. Amorocho D.[1], H. Faßbender[2]

[1]TU Braunschweig, jamoroch@tu-braunschweig.de
[2]TU Braunschweig, h.fassbender@tu-braunschweig.de

The trajectory piecewise-linear approach (TPWL) is a technique for the model order reduction of large nonlinear electronic devices [Rewiensky03]. This method approximates a nonlinear ordinary differential system by a nonlinear convex combination of reduced linear models. This approximation is done in three steps. First, the large nonlinear equation is simulated along a fixed trajectory to find several linear models that capture the nonlinear behavior of the system. Second, linear model order reduction methods are used to build a global projector using the previously found linear models. Finally, a reduced nonlinear model is obtained by assembling these reduced linear models as a nonlinear convex combination via a series of predefined functions called weight functions.
Despite been widely studied (e.g. [Striebel08, Voss05]), there are several open issues concerning TPWL. We discuss two of these issues, namely the appropriate choice of the weight functions and sound criteria to select linear models that capture the nonlinear behavior with low redundancy. Specifically, we propose new weight functions that provide the same order of accuracy as the original weight functions, but are computational more efficient. Additionally, we present an alternative way to obtain the linear models based on the difference between the nonlinearity and its linearization.[1]

References

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