Development of a Multirate Method for Adjoint Sensitivity Analysis in Nonlinear Networks.

TECHNISCHE UNIVERSITÄT DARMSTADT

Proposal for a Bachelor's thesis | Master's thesis | HiWi job
Study field: Computational Engineering | Electrical Engineering
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Description

In different fields of electrical engineering, such as power electronics or microwave engineering, the analysis of nonlinear electric networks is an important task. As simulations for large scale nonlinear networks are numerically expensive, a structured approach for the analysis and optimization of such networks is advised. In some applications, sensitivity analysis is used as an advanced approach to optimize given networks. Sensitivity analysis is a study of how certain system parameters p influence the properties of a given quantity of interest (QoI). The result is a very descriptive measure for the identification of relevent system parameters. For networks with a large number of system parameters p, an adjoint sensitivity analysis shows advantages, as its computational cost is independent of the number of system parameters p. Given the case, that the network contains largely scattered time scales, this analysis runs into issues if the sensitivity for the QoI has to be found at many points in time.

Work plan

The aim of the student work is to develop a multirate sensitivity analysis, which splits the timescales into two or more domains, with the goal to find an efficient measure for the analysis. A research on available multirate methods shall be performed, a prefered approach shall be identified and a demonstration solver shall be implemented. Afterwards, the adjoint sensitivity analysis shall be implemented based on the given solver. Where possible, available network solvers (e.g. Xyce) can be used to support the task.

Prerequisites

Basic knowledge of numerical analysis, experience with programming with script languages such as Python, Matlab or comparable, interest in power electronics and applied numerics.–

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