

Numerical simulation of differential algebraic equations with random parameters

Roland Pulch (Bergische Universität Wuppertal)

We consider mathematical models of dynamical systems given by differential algebraic equations (DAEs). Some of the involved physical parameters often exhibit uncertainties due to measurement errors or imperfections of a manufacture process, for example. A stochastic modelling enables an uncertainty quantification, where the corresponding parameters are replaced by random variables. Consequently, the time-dependent solution of the DAEs represents a random process now. The moments of the random process can be resolved by sampling techniques like quasi-Monte-Carlo methods, for example. Alternatively, we focus on numerical techniques using the expansions of the polynomial chaos, where unknown coefficient functions have to be determined approximately. The index of a system of DAEs characterises its analytical and numerical properties. We investigate the index of the DAEs, which appear in the numerical methods for solving the stochastic model. The occurrence of a different index for varying parameters deserves closer attention and implies corresponding modifications of the numerical methods. Finally, we present numerical simulations of test examples from mathematical models of electric circuits.