On Simple Impasse Points and Their Numerical Computation

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Abstract

Impasse Points are a well-known phenomenon in the theory of nonlinear circuits, which are often modelled by semiexplicit differential-algebraic equations (DAE's). They are a special kind of singularity of the DAE since the index-1-condition for the DEA is locally violated there. We consider a class of quasilinear DAE's more generally. We classify simple singularities as those which can be overcome by a transformation of the independent variable leading to an augmented DAE with geometrical or differential index 1. On this basis, we derive sufficient conditions for a simple singularity to be an impasse point and show a way to compute such points using standard software for index-1-DAE's. We analyse properties of solutions with a simple impasse point and study numerical properties of the used augmented systems.