Convergence of Galerkin Solutions for Linear Differential Algebraic Equations in Hilbert Spaces

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Abstract

The simulation of complex systems describing different physical effects becomes more and more of interest in various applications. Examples are couplings describing interactions between circuits and semiconductor devices, circuits and electromagnetic fields, fluids and structures. The modeling of such complex processes often lead to coupled systems that are composed of ordinary differential equations (ODEs), differential-algebraic equations (DAEs) and partial differential equations (PDEs). Such coupled systems can be regarded in the general framework of abstract differential-algebraic equations.

Here, we to discuss a Galerkin approach for handling linear abstract differential-algebraic equations with monotone operators. It is shown to provide solutions that converge to the unique solution of the abstract differential-algebraic system. Furthermore, the solution is proved to depend continuously on the data. The most interesting point of the Galerkin approach is the choice of basis functions. They have to be chosen in proper subspaces in order to guarantee that the solution satisfies the non-dynamic constraints. In contrast to other approaches, this approach allows time dependent operators but needs monotonicity.