Numerical Experiments with the Least-Squares Collocation Method & 1st Steps Towards Piecewise Differentiable Hermite Expansions of Certain Nonsmooth Vector-Valued Functions in Abs-Normal Form

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This presentation is divided into two parts. Firstly, we will take a look into numerical convergence diagrams produced by the least-squares collocation method as described by M. Hanke, R. März and C. Tischendorf applied to some systems of nonlinear differential algebraic equations in simplified proper form. To that end we will shortly introduce the algorithmic description of that method and briefly discuss our prototype implementation. We will also address necessary and missing features as part of potential developments in the future for its applicability in gas network simulation.
Secondly, we will revisit and recall piecewise differentiable Taylor expansions and derive ideas on how to approach Hermite expansions in the context of vector valued functions consisting of sums, products and unary operations as well as piecewise differentiable functions.

Keywords: least-squares collocation, non-smooth and piecewise differentiable functions, generalized Taylor & Hermite expansions, numerical integration of differential algebraic equations (DAE), algorithmic or automatic differentiation, abs-normal form