## *Error analysis for Galerkin-BDF discretizations of nonlinear differential-algebraic systems of index-1 with an elliptic operator constraint*

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R 3.28 Mon Z2 16:40-17:05

The dynamics of flow networks (e.g. circuits) can often be described by a differential-algebraic system (DAE). However, it is restricted to lumped network element models. If spatial effects can not be neglected, distributed element models have to be included. Here, we are interested in networks that include distributed elements of elliptic type. Therefore, we consider index-1 DAEs of the form

$$\begin{aligned} \frac{\mathrm{d}}{\mathrm{d}t} m(x(t), t) + f(x(t), y(t), u(t), t) &= 0, \\ g(x(t), y(t), t) &= 0 \end{aligned}$$

coupled with a constraint of the form

$$\mathcal{B}(u(t)) + \mathcal{R}(x(t), y(t), t) = 0$$

where $\mathcal{B}\colon V \to V^*$ is a strongly monotone and hemicontinuous operator and $V$ is a separable Banach space. Under some additional monotonicity and Lipschitz assumptions, we present an error analysis for discretizations of such systems based on a Galerkin approach for the operator constraint and the BDF method for the time discretization of the full system.