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General Stabilization Theory of Iterative Operator Splitting Methods and Applications

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ABSTRACT

We motivate our studying on the methods for solving complicate coupled and stiff equations coming from models for transport-reaction-, bio-remediation- and nonlinear diffusion-reaction-problems. The main advantage of the operator-splitting methods is decoupling the mixed processes into simpler synchronous physical processes. Because of the symmetry we could decouple such processes. To be more accurate and to come to higher order splitting methods, an effective a new group of methods is presented, based on higher order splitting methods. To stabilize the delicate initial process of such higher order methods, we present a stabilization with initial presteps and weighting factors for the iterative method, see [1], [3]. We present a discussion that analyzes the benefits of splitting methods with respect to the control of the additional error bounds. Therefore the methods are applicable and can be preferred over other standard methods. Overall the hard core backbone of the methods are presented in a general and abstract form. We could overcome to Marchuk and Strang [4], [5], who are still too close to examples.

In the numerical experiments we apply our results to stiff systems of reaction- and convection-diffusion-reaction-equations, see [2].

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