Stability of Exponential Operator Splitting Methods for Non-contractive Semigroups

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Abstract: Operator splitting methods constitute an attractive class of time discretization schemes for evolution equations. Due to their computational advantages, they are widely used in scientific computation. Here we are interested in linear parabolic problems where the evolution is given by an analytic semigroup. Apart from the simple situation where the single operators generate semigroups of contractions, the stability of operator splitting methods in Banach spaces can be a delicate problem.

In this talk we derive a Banach space framework that allows us to prove the stability of the Lie–Trotter splitting for non-contractive semigroups under reasonable assumptions on the involved operators. The stability result is verified with the help of particular representation of the local error combined with an appropriate commutator bound. As an application we discuss the dimension splitting of strongly elliptic partial differential operators with sufficiently smooth coefficients.

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