High order splitting schemes with complex timesteps and their application in mathematical finance

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We consider the approximation of the solution of linear evolution equations by high order splitting methods. It turns out that if the generator of the problem is of the sum-of-squares type, which is typical for problems from mathematical finance, the functional analytic setting developed by Dörsek and Teichmann [1] allows us to prove the necessary analyticity of the generated semigroups easily. Full discretisations are obtained using Krylov methods for the approximation of the matrix exponential of the second order part and streamline diffusion finite elements for the first order part, whence robust error estimates for drift-dominated problems are possible. Numerical experiments illustrating the theoretical results are provided.

References

[1] Philipp Dörsek and Josef Teichmann. A Semigroup Point Of View On Splitting Schemes For Stochastic (Partial) Differential Equations. *ArXiv e-prints*, November 2010.