
David L. Ropp
**On the Instability of Operator Splitting Methods:
Diffusion/Reaction Systems***

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Recently numerical experiments have demonstrated the instability of some common second-order operator splitting methods when applied to the Brusselator system. In this talk we demonstrate that this instability can be related to the stability properties of the method used to integrate the diffusion operator. We then consider the stability of operator splitting methods applied to a model diffusion/reaction system that exhibits decay (a negative definite operator) but has a reaction operator which allows growth (a positive semi-definite or indefinite?). Using this equation we consider the A-stability of the operator split schemes and derive conditions on the diffusion integrator to achieve A-stability. We demonstrate consequences of this theorem for this model problem and demonstrate the result in the case of the Brusselator system as well.

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