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Operator-splitting methods for qualitative property preservation of production-destruction systems

When solving a production-destruction system, the numerical solution should respect certain qualitative properties that reflect the physical reality of the system. The SIR model is an example of a production-destruction system. Based on suitable assumption, the solution of the SIR model should preserve the positivity of all variables, conserve the total population, and preserve the monotonicity of the S and R variables. When using operator-splitting methods, three aspects affect the quality of the numerical solution: the splitting strategy of the system, the splitting scheme used for time integration, and the choice of the sub-integration methods. In this talk, we will use the SIR model to discuss how these aspects affect the desired qualitative properties.