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Runge-Kutta methods are stable

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The numerical solution of PDEs often ends up with a large system of ODEs, and a canonical choice for the solution of such systems of "method of lines"is the class of Runge-Kutta (RK) methods. Indeed, RK methods are used routinely for integration of large systems of ODEs encountered in various applications. But the standard stability arguments of RK method fail to cover arbitrarily large systems of ODEs. We explain the failure of different approaches, offer a new stability theory and demonstrate a few examples.

Presenter: TADMOR, Eitan (University of Maryland)