

*A Family of Runge-Kutta Restarters for Discontinuous ODEs*

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In this talk we present an extended idea of Runge–Kutta methods designed to restart multistep methods applied to ODEs with frequent discontinuities [3,4].

Multistep methods use information from previous steps to approximate the next value. A single step of these Runge–Kutta methods provides sufficiently accurate initial values to start a high order multistep method, whereas classical algorithms either apply a Runge–Kutta method several times or start with a variable order implementation. Both classical schemes can lead to inefficiency when the integration has to be interrupted frequently due to discontinuities.

We demonstrate the advantage of this approach by an extension of Assimulo [1] together with Sundials [2].

[1] Andersson, Christian, Claus Führer, and Johan Åkesson. "Assimulo: A unified framework for ODE solvers." *Mathematics and Computers in Simulation* (2015).

[2] Hindmarsh, Alan C., et al. "SUNDIALS: Suite of nonlinear and differential/algebraic equation solvers." *ACM Transactions on Mathematical Software (TOMS)* 31.3 (2005): 363-396.

[3] C. W. Gear. Runge–Kutta starters for multistep methods. *ACM Trans. Math. Softw.*, 6(3):263–279, September 1980.

[4] Reinhold von Schwerin and Hans Georg Bock. A Runge–Kutta starter for a multistep method for differential-algebraic systems with discontinuous effects. *Applied numerical mathematics*, 18(1):337–350, 1995.