



## ONE-STEP HERMITE-BIRKHOFF-TAYLOR METHODS

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### Abstract

A one-step, 4-stage, Hermite-Birkhoff-Taylor (HBT) method of order 6, denoted by HBT (4, 6), is constructed for non-stiff ODE. Then an optimal Strong-Stability-Preserving (SSP), one-step, 9-stage, HBT method of order  $p = 6, \dots, 12$ , denoted by HBT (9,  $p$ ), is constructed for time discretization methods integrating hyperbolic conservation laws. The method uses derivatives  $y$  to  $y^{(p-3)}$  as in Taylor methods combined with a 9-stage Runge-Kutta (RK) method of order 4. Forcing an expansion of the numerical solution to agree with a Taylor expansion of the true solution leads to Taylor and RK-type order conditions. The Shu-Osher form of RK methods is extended to the above combined methods. These SSP HBT methods have predictors of order at least 3, compared to predictors of order one for RK methods and hence are less susceptible to order reduction from source terms or non-homogeneous boundary conditions.

**Keywords and phrases:** Hermite-Birkhoff-Taylor method, Taylor method, Runge-Kutta method.

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