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Numerical solution of nonlinear conservation laws using TVD semi-implicit scheme

Michal ŽERAVÝ [*], Peter FROLKOVIČ [†]

In this talk, we deal with the numerical solution of nonlinear conservation laws using a novel class of semi-implicit schemes as published for linear advection equations in [1, 2]. We present an extension of the method for linear and nonlinear conservation laws where the free parameter of the method is used to suppress unphysical oscillations for nonsmooth solutions using some standard and newly developed TVD limiters. The resulting nonlinear scheme is unconditionally stable and it requires only the application of a local nonlinear algebraic solver due to the nonlinearity in the flux function and the dependence of the parameter on the numerical solution. The scheme can be viewed as a second-order accurate extension of the first-order accurate scheme presented in [3] and it is related to [4].

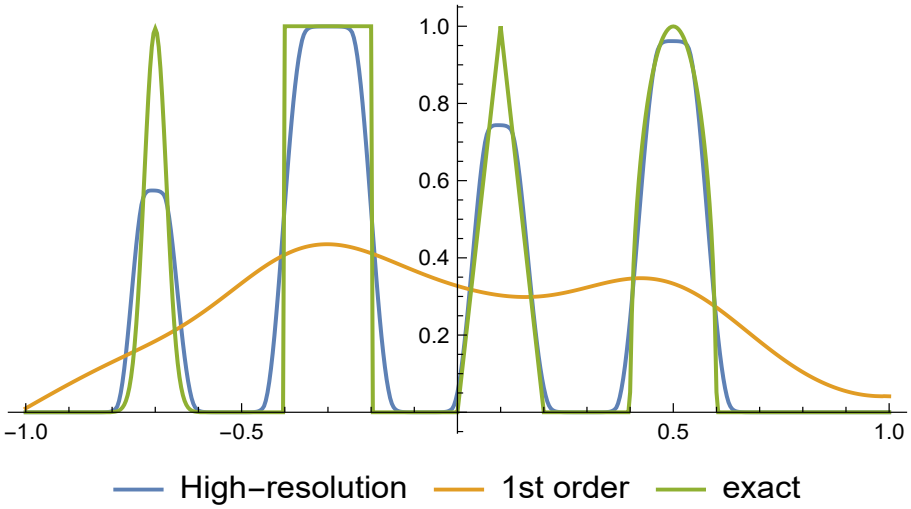

Figure 1: Comparison of exact solution (green) with numerical solutions obtained with fully implicit first-order accurate scheme [3] (orange) and the new TVD second-order accurate semi-implicit scheme (blue) for linear advection with constant speed after one period with Courant number equals 4 and $h = 2/500$. Example taken from [5].

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[*]Faculty of Civil Engineering, Slovak University of Technology, Bratislava, Slovakia. Email: michal.zeravy@stuba.sk
[†]Faculty of Civil Engineering, Slovak University of Technology, Bratislava, Slovakia. Email: peter.frolkovic@stuba.sk

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