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Optimised explicit finite difference scheme for the KdV equation

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In this work, we consider the Korteweg-de Vries equation and its variants which are third order nonlinear partial differential equations. It originates from many physical phenomena, for example, the flow of liquids containing gas bubbles, in the study of the propagation of waves in an elastic tube filled with a viscous fluid and also for the description of shallow water waves on viscous fluid.

We start by designing implicit finite difference schemes that conserve the first three integrals: mass, momentum and energy. The derived schemes being implicit are difficult to implement and consume more computer time, hence quest for explicit finite difference schemes is highlighted since they are easy to implement and consume less computer time. Here we investigate explicit schemes for the Korteweg de Vries equations and it's variant.

With regards to these schemes, several numerical experiments are carried out to analyse their spectral properties. Their performance is compared with regards to dispersive and dissipative errors and their ability to conserve the first three integrals. In addition, an optimisation procedure is carried out to determine the optimum spatial step size that produces the minimum error. Graphical presentation of results obtained shed more light.

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