

Accepted Manuscript

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PII: S0377-0427(18)30011-6
DOI: <https://doi.org/10.1016/j.cam.2017.12.043>
Reference: CAM 11462

To appear in: *Journal of Computational and Applied Mathematics*

Received date: 20 November 2015
Revised date: 27 May 2016

Please cite this article as: C. Yu, B.-F. Feng, T.W.H. Sheu, Numerical solutions to a two-component Camassa–Holm equation, *Journal of Computational and Applied Mathematics* (2018), <https://doi.org/10.1016/j.cam.2017.12.043>

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Numerical solutions to a two-component Camassa-Holm Equation

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Abstract

In the present paper, a three-step iterative algorithm for solving a two-component Camassa-Holm (2CH) equation is presented. In the first step, the time-dependent equation for the horizontal fluid velocity with nonlinear convection is solved. Then an inhomogeneous Helmholtz equation is solved. Finally, the equation for modeling the transport of density is solved in the third step. The differential order of 2CH equation has been reduced in order to facilitate numerical scheme development in a comparatively smaller grid stencil. In this study, a fifth-order spatially accurate upwinding combined compact difference scheme (UCCD5) which differs from that in [J. Comput. Phys. 230 (2011) 5399-5416] is developed in a four-point grid stencil for approximating the first-order derivative term. For the purpose of retaining long-time Hamiltonians in the 2CH equation, the time integrator (or time-stepping scheme) chosen is symplectic. Various numerical experiments such as the single

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