Accepted Manuscript

Numerical solutions to a two-component Camassa–Holm equation

Ching-Hao Yu, Bao-Feng Feng, Tony W.H. Sheu

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

Numerical solutions to a two-component Camassa-Holm Equation

Ching-Hao Yu[1], Bao-Feng Feng[2,*], Tony W. H. Sheu[3,4,5,†]

[1]*State key lab of Hydraulics and Mountain River Engineering, Sichuan University, Sichuan 610000, People's Republic of China*

[2]*School of Mathematical and Statistical Sciences, The University of Texas Rio Grande Valley, Edinburg 78539, U.S.A.*

[3]*Department of Engineering Science and Ocean Engineering, National Taiwan University, No. 1, Sec. 4, Roosevelt Road, Taipei, Taiwan, Republic of China*

[4]*Institute of Mathematical and Applied Mathematics, National Taiwan University*

[5]*Center for Advanced Study on Theoretical Sciences (CASTS), National Taiwan University*

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

*Corresponding author. E-mail address: baofeng.feng@utrgv.edu (B. -F. Feng)

†Corresponding author. Tel:+886-2-33665746; Fax:+886-2-23929885. E-mail address: twhsheu@ntu.edu.tw (Tony W. H. Sheu)