A semi-analytical method for the one-dimensional Burgers' equation

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Abstract: In this paper, a semi-analytical method is presented for analyzing the response of one-dimensional Burgers' equation involving very high Reynolds number. Based on the Hopf-Cole transformation and symmetry transformation, the one-dimensional Burgers' equation in a finite space domain is transformed into the heat transfer equation in the infinite space domain. Then, a semi-analytical method is presented for the heat transfer equation in the infinite space domain, which gives accurate solution for one-dimensional Burgers' equation. The performance of the method is tested on the Burgers' equation involving very high Reynolds numbers. The obtained numerical results show that the method is accurate, efficient, stable, reliable and can capture shock waves accurately for solving Burgers' equation even involving very high Reynolds numbers for which the exact solution and other numerical methods fail.

Keywords: Burgers' equation; Hopf-Cole transformation; Shock wave; Numerical method.