Abstract

In this study, spatio-temporal discretization for semilinear dissipative partial differential equations type is introduced, analyzed and implemented. The model studied here is the dispersively Kuramoto–Sivashinsky equation with an additional term representing the dispersive term, arising in turbulent gas flow over laminar liquid (Tseluiko and Kalliadasis, 2011). This additional term is multiplied by a parameter that represents the influence of the turbulent gas flow. Our objective is to examine the effect of this additional term on the dynamics of the Kuramoto–Sivashinsky equation characterized by its chaotic behavior. This is achieved by combining the Exponential Time Differencing Crank–Nicolson (ETD-CN) scheme derived by Kleefed et al. (2012), and Fourier pseudospectral schemes for temporal and spatial stepping, respectively. The method is known to be stable and second order convergent. In addition, a theoretical study and a plot of stability regions of ETD-CN were performed showing its effectiveness for the stiff problem studied here.