Investigation of Riemann wave propagating for the variable coefficients complicated nonlinear physical phenomena

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Abstract

We are exploring solitons and other solutions describe new interaction between two solitons besides, new three soliton solutions are generated. we examine the commutative product between multi unknown Lie infinitesimals for the (2+1) dimensional variable-coefficients Bogoyavlensky Konopelchenko (VCBK) equation and this study result some new Lie vectors. The commutative product generates a system of nonlinear ODEs which had been solved manually. Through two stages of Lie symmetry reduction, (VCBK) equation is reduced to non-solvable nonlinear ODEs using various combinations of optimal Lie vectors. Using the Integration method, we investigate new analytical solutions for these ODEs. Back substituting to the original variables generates new solitons and other solutions for (VCBK). Some selected solutions illustrated through three-dimensional plots.

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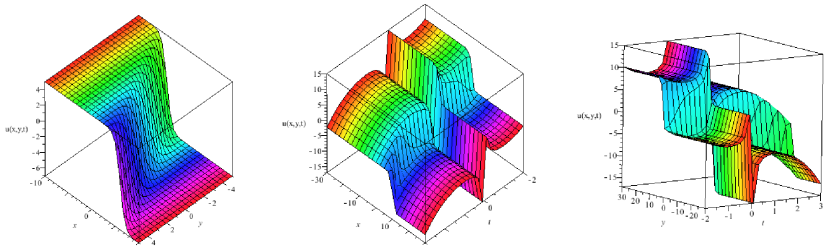
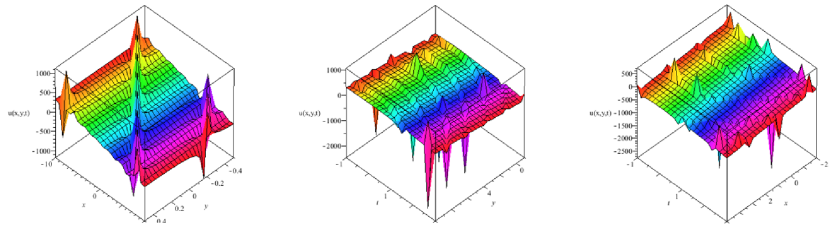


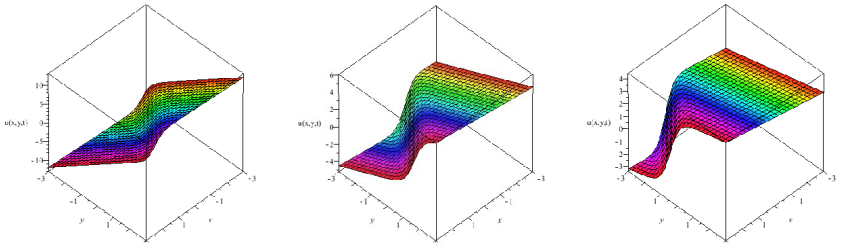
(a) (b) (c)

Fig.1. Three dimensional plots for $v(x, y, t)$ at $c_1 = -1$, $c_2 = 1$, $c_4 = 1$, (a) $t = 0.5$, (b) $y = 0$ and (c) $x = 0$.



(a) (b) (c)

Fig.2. Three dimensional plots for $v(x,y,t)$ (a) $t = 0$, (b) $x = 0$ and (c) $y = 0$.



(a) (b) (c)

Fig.3. Three dimensional plots for $v(x, y, t)$ for $c_1 = 1, c_2 = 2, c_4 = \frac{-1}{18}$ (a) $t = 0.4$, (b) $t = 0.6$ and (c) $t = 1$.