On One Nonlinear Elliptic Equation

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In this paper we focus our attention on the nonlinear elliptic equation connected with the solitary waves

$$(a_0 + a_1\psi - a_2\psi^2)\Delta\psi + (b_1 - b_2\psi)\nabla^2\psi + \lambda_0\psi^\delta - \lambda_0^*\psi^2 - A_0(\psi - b_0\psi^3) = 0, \qquad (1)$$

where ψ is unknown function, the constants $a_0, a_1, a_2, b_0, b_1, b_2, A_0, \lambda_0, \lambda_0^*$ will be chosen accordingly, δ is a real constant. The case $\delta = 2, \lambda_0 = \lambda_0^*, a_0 = 1, a_1 = a_2 = 0, b_1 = 0, b_2 = 1, A_0 = 0$ was considered in [1] for the finite area. We consider this equation in the infinite area in the cases $\delta = 1, \delta = 2$ and $\delta = 3$.

The equation (1) is connected with the cubic nonlinear Schrödinger type equation (NLS) [2,3], which describes wide range of physical phenomena such as electron plasmatic waves, electromagnetic ion cyclotron waves, waves in cosmic gases.

The effective solutions of (1) exponentially vanishing at infinity and having peaks at some lines are obtained. Solitary waves connected with these solutions in the specific class of functions are plotted by using Maple.

References

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