Nonlinear Partial Differential Equations

Boundary value problems and equations arising in fluid mechanics

On decay and symmetry of traveling wave solutions to the Whitham equation

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The Whitham equation is a nonlocal, nonlinear dispersive wave equation introduced by G. B. Whitham as an alternative wave model equation for the Korteweg-de Vries equation, describing the wave motion at the surface on shallow water. Knowing that traveling wave solutions to the Whitham equation exist, we focus on symmetry and decay properties of traveling wave solutions on the line. In particular, we show that any continuous solitary wave solution is symmetric and decays exponentially fast at infinity. Moreover, the structure of the Whitham equation allows to conclude that conversely any classical symmetric solution constitutes a traveling wave. In fact, the latter result holds true for a large class of partial differential equations sharing a certain structure.