

Nonlinear Partial Differential Equations

Boundary value problems and equations arising in fluid mechanics

Non-uniform dependence on initial data for the Whitham equation

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We consider the Cauchy problem for the Whitham equation on the torus and on the real line and prove that the solution map for the Whitham equation is not uniform in $H^s(\mathbb{T})$ or $H^s(\mathbb{R})$ for $s > \frac{3}{2}$. This is done by constructing two sequences of solutions in $H^s(\mathbb{T})$ ($H^s(\mathbb{R})$), converging to the same limit at the initial time while the distance at any later time is bounded below by a positive constant. The result is also extended to a wide class of Whitham-type equations by considering more general dispersive terms, covering, amongst other equations, fractional Korteweg-de Vries equations and the capillary Whitham equation.