Normal forms and KP solitons

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Abstract:

The KP equation describes two-dimensional nonlinear dispersive waves at the leading order approximation under the assumptions of small amplitude, weakly dispersive and quasi-two dimensionality. We develop a normal form theory to study the higher order corrections to the KP equation including the effects of larger amplitude and higher dispersion and diffraction in both x- and y-directions. For the case of one-dimensinal problem where the KdV equation gives the leading order approximation, we have developed the normal form theory in [1,2] and found that the first order correction to the KdV equation can be transformed to the 5th order KdV equation, that is, the perturbed equation is *asymptotically* integrable up-to this order. However, in the case of the KP equation, there are several obstacles to obtain the similar results for asymptotic integrability. The normal form theory for the KP equation in [3] states that in the next order correction, there are five conditions among ten higher order terms for the asymptotic integrability. In this talk, I will explain the detailed structure of the normal form theory, and present an application of the theory to real experiments of shallow water waves.

References:

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