Geophysical Research Abstracts
Vol. 16, EGU2014-14392, 2014
EGU General Assembly 2014

The stability of freak waves with regard to external impact and perturbation of initial data

Anna Smirnova (1) and Roman Shamin (2)

(1) Peoples‘ Friendship University of Russia, Moscow, Russia (smirnovaanna91@gmail.com), (2) Institute of Marine Geology and Geophysics RAS, Yuzhno-Sakhalinsk, Russia (roman@shamin.ru)

We investigate solutions of the equations, describing freak waves, in perspective of stability with regard to external impact and perturbation of initial data. The modeling of freak waves is based on numerical solution of equations describing a non-stationary potential flow of the ideal fluid with a free surface. We consider the two-dimensional infinitely deep flow. For waves modeling we use the equations in conformal variables. The variant of these equations is offered in [1]. Mathematical correctness of these equations was discussed in [2]. These works establish the uniqueness of solutions, offer the effective numerical solution calculation methods, prove the numerical convergence of these methods. The important aspect of numerical modeling of freak waves is the stability of solutions, describing these waves. In this work we study the questions of stability with regards to external impact and perturbation of initial data.

We showed the stability of freak waves numerical model, corresponding to the external impact. We performed series of computational experiments with various freak wave initial data and random external impact. This impact means the power density on free surface. In each experiment examine two waves: the wave that was formed by external impact and without one. In all the experiments we see the stability of equation‘s solutions. The random external impact practically does not change the time of freak wave formation and its form. Later our work progresses to the investigation of solution’s stability under perturbations of initial data. We take the initial data that provide a freak wave and get the numerical solution. In common we take the numerical solution of equation with perturbation of initial data. The computing experiments showed that the freak waves equations solutions are stable under perturbations of initial data.So we can make a conclusion that freak waves are stable relatively external perturbation and perturbation of initial data both.

1. Zakharov V.E., Dyachenko A.I., Vasilyev O.A. New method for numerical simulation of a nonstationary potential flow of incompressible fluid with a free surface// Eur. J.∼Mech. B Fluids. 2002. V. 21. P. 283-291.
2. R.V. Shamin. Dynamics of an Ideal Liquid with a Free Surface in Conformal Variables // Journal of Mathematical Sciences, Vol. 160, No. 5, 2009. P. 537-678.
3. R.V. Shamin, V.E. Zakharov, A.I. Dyachenko. How probability for freak wave formation can be found // THE EUROPEAN PHYSICAL JOURNAL - SPECIAL TOPICS Volume 185, Number 1, 113-124, DOI: 10.1140/epjst/e2010-01242-y