

Extreme Ocean Gravity Waves: Analysis and Prediction on the Basis of Breather Solutions in Nonlinear Evolution Equations

Initiative: Modellierung und Simulation komplexer Systeme (beendet)

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Extreme ocean gravity waves are a mysterious phenomenon of giant waves appearing in the deep ocean seemingly from nowhere. They tend to disappear without a trace just the way they appeared. Their existence in the world ocean is a well established fact but present understanding is poor. One of the theories that may explain these extreme waves is based on breather solutions of nonlinear wave equations. Generation of breathers and their combinations can be a reason for the formation of extreme waves. Thus, modeling of such solutions may lead to understanding the nature of this phenomenon. Modeling of breather solutions of the Nonlinear Schrödinger Equations will allow to describe these waves mathematically, possibly predict their appearance and perhaps eliminate them at strategically important locations, e.g. offshore structures. These results are compared with direct numerical simulations of the fully nonlinear Euler equations and their weakly nonlinear approximations. In addition, data based tools to anticipate rogue waves are investigated.

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