EGU22-7300
https://doi.org/10.5194/egusphere-egu22-7300
EGU General Assembly 2022
© Author(s) 2022. This work is distributed under
the Creative Commons Attribution 4.0 License.

The Zakharov Equation as a Model for Wind Waves: Nearby Integrability, Hamiltonian Perturbations and Multiply Periodic Fourier Series

Alfred Osborne
Nonlinear Waves Research Corporation, Alexandria, Virginia, U. S. A.

The Zakharov equation is a fundamental equation of water waves that is used as a dynamical model for wind wave growth/decay. A nearby Lax integrable version of the Zakharov equation is studied and subsequently a Hamiltonian perturbation provides a close approximation of the Zakharov equation itself. Theorems of Kuksin, and Baker and Mumford are used to develop the algebraic-geometric solutions of the Zakharov equation in terms of the associated Its-Matveev formula. A subsequent derivation of a multiply periodic Fourier series solution is found which includes the coherent structure solutions (breathers) and cascading. The correlation function is computed and the space/time evolution of the Power spectrum is given analytic form, including a wind-wave transfer function appropriate for multiply periodic Fourier series. Some advantages of this method over classical kinetic equations are that the modulational instability is included together with coherent structure breather solutions. Furthermore, the weak interaction assumptions are no longer necessary in this new formulation, which retains the full nonlinear interactions of the Zakharov equation.