

Discrete and continuous random water wave dynamics

André Nachbin

IMPA, Est. D. Castorina, 110, J. Botânico, Rio de Janeiro, RJ, 22460-320, Brazil
Tel: 55-21-25295214, email: nachbin@impa.br

Abstract:

Research on water waves propagating over, large amplitude, random bottom topography in general requires good reduced models, good asymptotic theory plus accurate/reliable numerical simulations. Usually the truncation procedure regarding the continuous dynamics (namely in obtaining the reduced models) is quite different from that performed in order to get the discrete models. Hence, when possible, it is very important to compare the statistics produced by the continuous dynamics with those produced by the discrete one. This is the main issue addressed in this talk.

First I will briefly review some results on the effective dynamics of water waves in the presence of highly disordered (random) forcing by the topography. Then I will address a recent study where the long wave (random) reflection process, generated through potential theory, comes out to be the same as the one generated by a hydrostatic model. The regime under study accounts for large amplitude, rapidly varying topographies. To validate/illustrate this limiting reflection process issue the (dimensionless) theoretical results were compared against Monte Carlo simulations with a hydrostatic (dimensional) Navier-Stokes numerical model. The challenge in this part of our work was to first set the numerical data accordingly with the dimensionless regime of interest, and then compare the numerical statistics with that given by the stochastic theory. Namely, the discrete signals were (Monte Carlo) averaged and compared to a Central Limit Theorem characterization for the continuous reflection process. Very good agreement was observed. The simulations were then pushed beyond the regime of validity of the theory, leading to interesting questions.