

Invited Lecture
OMAE Safety and Reliability Symposium

QUASI-DETERMINISM THEORY OF SEA WAVES

Paolo Boccotti
'Mediterranea' University of Reggio Calabria, Italy

If a wave of given exceptionally large height H occurs at some point x_0, y_0 at sea, then, with a very great probability, the free surface displacement around that point will be very close to a well-defined deterministic wave function, which depends on the covariance Ψ (with both time and space lags) of the random free surface displacement.

On an open sea, said deterministic wave function represents a three dimensional wave group which has a development stage characterized by a spontaneous focussing. This focussing leads to the occurrence of the wave of given exceptionally large height H at point x_0, y_0 . Then a decay stage follows in which the three dimensional envelope stretches. Each individual wave has a propagation speed greater than the group, so that it runs along the envelope, from the tail where it is born to the head where it goes to die.

Some examples of application of the quasi-determinism theory to random wind-generated waves being non-homogeneous in space will be given in the lecture. In particular it will be shown what we may expect to happen if a wave of given exceptionally large height occurs at a point x_0, y_0 at a breakwater; and what we may expect to happen if a wave of given exceptionally large height occurs at a point x_0, y_0 far from a breakwater. In this case, the above cited deterministic wave function represents the collision of two wave groups: one going back seaward after having been reflected, and one approaching the breakwater.