Abstract View

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Nonlinear Energy Transfer Between Wind Waves

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ABSTRACT

A computational scheme for calculating transfer functions is prepared, which gives much improved numerical stability and smoothness compared with previous studies. Besides, a detailed analysis is made of the kernel function, in which the essence of nonlinear energy transfer is summarized. Then the scheme is applied to typical spectra of wind waves. In particular for the JONSWAP spectrum the present results are qualitatively similar to those of Sell and Hasselmann rather than those of Fox. At the same time a clear account is given of the discrepancy between transfer functions obtained from the original model of Hasselmann and those determined from the simplified model of Longuet-Higgins. The latter model turns out to be inadequate for ordinary spectra of wind waves observed in the ocean and laboratories. Also the effects of the sharpness of the spectral form on transfer functions are examined systematically. Furthermore, an example is presented which shows that for a spectrum expressed as a sum of two spectra with peak frequencies and peak spectral densities different from each other, energy flows so as to smooth out the smaller spectral peak at the higher frequency much more intensely than expected from a simple superposition. A comparison of calculated transfer functions with experiment indicates that nonlinear energy transfer plays a principal role in the evolution of the wave field in decay areas.