Rogue Waves in Near Gaussian Sea States

Alfred R. Osborne

Nonlinear Waves Research Corporation, Alexandria, VA (al.osborne@gmail.com)

The field of nonlinear waves often emphasizes the importance of small amplitude modulations in the nonlinear Schroedinger equation (NLS). The Akhmediev and Peregrine breather trains are examples which manifest themselves from the usual linear instability analyses of NLS. In reality, however, oceanic sea states generated by wind waves are very nearly Gaussian processes and so the modulus of the Hilbert transform envelope is approximately Rayleigh distributed (with of course the possibility of a large amplitude tail) and is therefore never a small amplitude modulation. How can we then reconcile our usual perceptions with this fact? What are indeed the solutions of the nonlinear Schroedinger equation non Gaussianity have on the actual types of solutions that are likely to occur in the real ocean? I discuss how finite gap theory for NLS allows us to answer these and many more questions about rogue sea states. I analyze data from various laboratory and oceanic experiments to illustrate the method. Finally, I discuss whether breather trains such as Akhmediev, Peregrine and Ma-Kuznetsov can actually occur in ocean wave data.