Craig, Walter

Solitary wave interactions (joint work with P Guyenne, D Henderson, J Hammack & C Sulem)

Solitary waves for the Euler equations have been a topic of interest since the time of Stokes. In a small amplitude long wave perturbation regime they are well described by single soliton solutions of the Korteweg deVries equation (KdV), and it is a famous result that the multiple soliton solution of the KdV exhibits elastic collisions. The question is as to what extent interactions between Stokes solitary waves fail to do so. I will report on new numerical, experimental and analytical results on this point, concerning both co-propagating and counter-propagating cases of large amplitude solitary waves. In all cases we quantify the degree to which interactions are inelastic, but it is remarkable how small the residual is from a collision of even very large solitary waves.

Using the fact that the total mass, momentum and energy of free surface water waves are conserved, and the fact that the Stokes solitary waves occur in a one parameter family, we give a relation between amplitude change due to an interaction and the energy loss to a residual, and we prove an upper bound on the size of the residual of a solitary wave interaction. This improves the results for general initial data given in Craig (1985), Schneider & Wayne (2000), Bona, Colin & Lannes (2005) and Wright (2005). Our observations however call into question the classical asymtotic analysis of Su & Mirie (1980) on such collisions, and indicate that this analysis should be revisited.

Abstract of talk given at ICMS Workshop on Rogue Waves December 2005.
www.icms.org.uk