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Three Dimensional Gravity Water Waves

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Three dimensional gravity water waves are ubiquitous, and of importance to physical oceanography and marine engineering. Yet being a complex nonlinear process the study of water waves remains a rich source of mathematical problems, whose answers can be of relevance to ocean scientists. My presentation concerns the form of three dimensional traveling water waves, contrasting the geometry of waves over deep water with the shallow water regime. In particular, solutions typically occur in two-parameter bifurcation families, which can have complex secondary bifurcations in resonant situations. The rigorous mathematical theory will be compared with numerical computations and controlled laboratory experiments. I will also discuss the existing stability theory, especially of the deep water case.

View the extended summary