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Whitham-Boussinesq model for variable depth topography. Results on normal and trapped modes for non trivial geometries.

The water-wave problem describes the evolution of an incompressible ideal, irrotational fluid with a free surface under the influence of gravity. A significant development in water-wave theory was the discovery by Zakharov in 1968 that the problem has a Hamiltonian structure and later W. Craig and C. Sulem introduced the Dirichlet-Neumann operator explicitly on the Hamiltonian. In this talk I will present a joint work with Prof. Panayotis Panayotaros and Prof. Antonmaria Minzoni from Universidad Nacional Autónoma de México, we propose a simplified long wave model combining a variable depth generalization of the exact nonlocal dispersion with the standard Boussinesq nonlinearity. The model relies on an approximate Dirichlet-Neumann operator that preserves some key structural properties of the exact operator and is simpler than alternative perturbative or implicit expressions. We examine the accuracy of this approximation by studying linear (2-D) normal modes and (3-D) longitudinal and Ursell modes for some geometries for which there are exact results.