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Kinematics and dynamics of a solitary wave interacting with varying bathymetry and/or a vertical wall

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In this work, we investigate the transformations that solitary surface waves undergo during their interaction with uneven seabed and/or fully reflective vertical boundaries. This is accomplished by performing simulations using a non-local Hamiltonian formulation, taking into account full nonlinearity and dispersion, in the presence of variable seabed [1]. This formulation is based on an exact coupled-mode representation of the velocity potential, leading to efficient and accurate computations of the Dirichlet to Neumann operator, required in Zakharov/Craig-Sulem formulation [2], [3]. In addition, it allows for the efficient computation of wave kinematics (velocity, acceleration) and the pressure field, in the time-dependent fluid domain, up to its physical boundaries. Such computations are performed for the case of high-amplitude solitary waves interacting with varying bathymetry and/or a vertical wall, shedding light to their kinematics and dynamics. More specifically, we first consider two benchmark cases, namely the transformation of solitary waves over a plane beach [4], and the reflection of solitary waves on a vertical wall [5]. As a further step, results on the scattering/reflection of a solitary wave due to an undulating seabed, and on the disintegration of a solitary wave travelling form shallow to deep water are also presented.

References:

[1] G.A. Athanassoulis. & Ch.E. Papoutsellis, in Volume 7: Ocean Engineering, ASME, OMAE2015-41452, p. V007T06A029 (2015)
[2] W. Craig, C. Sulem, *J. Comp. Phys.* **108**, 73-83 (1993)
[3] V. Zakharov, *J. Appl. Mech. Tech. Phys* **9**, 86–94 (1968)
[4] S. Grilli, R. Subramanya, T. Svendsen. & J. Veeramony, *J. Waterway, Port, Coastal, Ocean Eng.* **120**(6), 609–628. (1994)
[5] Y.Y. Chen, C. Kharif , J.H. Yang, H.C. Hsu, J. Touboul & J. Chambarel, *Eur. J. Mech B-Fluid* **49**, 20-28 (2015)