Physics > Classical Physics

Practical use of variational principles for modeling water waves

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This paper describes a method for deriving approximate equations for water waves. The method is based on a `relaxed' variational principle, i.e., on a Lagrangian involving as many variables as possible. This formulation is particularly suitable for the construction of approximate water wave models, since it allows more freedom while preserving the variational structure. The advantages of this relaxed formulation are illustrated with various examples in shallow and deep waters, as well as arbitrary depths. Using subordinate constraints (e.g., irrotationality and free surface impermeability) in various combinations, several model equations are derived, some being well-known, other being new. The models obtained are studied analytically and exact travelling wave solutions are constructed when possible.

Comments:	29 pages, 50 references. Other author's papers can be downloaded at this http URL
Subjects:	**Classical Physics (physics.class-ph)**; Analysis of PDEs (math.AP); Pattern Formation and Solitons (nlin.PS); Exactly Solvable and Integrable Systems (nlin.SI)
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