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A nonlinear Schrödinger equation for capillary-gravity water waves on finite depth with constant vorticity

Hung-Chu Hsu (1), Christian Kharif (2), Marc Francius (3), and Yang-Yih Chen (1)

(1) Tainan Hydraulics Laboratory, National Cheng Kung University,Tainan,Taiwan (hungchuhsu@gmail.com), (2) IRPHE, UMR 6594 , 49 rue F. Joliot Curie BP 146, Marseille 13384, France.(kharif@irphe.univ-mrs.fr), (3) Université de Toulon, CNRS/INSU, IRD, MOI, UM 110, 83957 La Garde, France. (francius@univ-tln.fr)

In this study a nonlinear Schrödinger equation governing the complex envelope of a capillary-gravity water wave train propagating on uniform vertical shear current is derived. When the vorticity and surface tension vanishes, the classical NLS equation is found. The influence of constant vorticity and surface tension on the well-known stability properties of weakly nonlinear wave packets is studied. It is demonstrated that vorticity and surface tension modifies significantly the modulational instability properties of weakly nonlinear plane waves, namely the growth rate and bandwidth. Comparison with a fully nonlinear approach is conducted, too.