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

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A nonlinear Schrödinger equation for the envelope of two dimensional surface water waves on finite depth with non zero constant vorticity is derived, and the influence of this constant vorticity on the well known stability properties of weakly nonlinear wave packets is studied. It is demonstrated that vorticity modifies significantly the modulational instability properties of weakly nonlinear plane waves, namely the growth rate and bandwidth. Furthermore, it is shown that these plane wave solutions may be linearly stable to modulational instability for an opposite shear current independently of the dimensionless parameter kh, where k and h are the carrier wavenumber and depth respectively. We may expect that the probability of rogue waves increases in the presence of shear currents co-flowing with the waves.