Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Weakly nonlinear theory for the initial value problem of three-dimensional deep water surface waves in a uniform shear field ANDREAS AKSELSEN, SIMEN ELLINGSEN, NTNU — We investigate the weakly nonlinear dynamics of gravity ring waves at infinite depth under the influence of a shear current varying linearly with depth. Although this problem cannot be treated using potential theory, a solution is permitted via integration of the Euler equations. The linear initial value problem is extended to the weakly nonlinear regime using an Euler expansion mode coupling method. A particle trajectory approximation, including Stokes drift effects, is obtained in a similar manner. Although this technique generally generates expressions of a complexity too great for numerical evaluation, comparatively simple asymptotic approximations can be constructed using a two-dimensional method of stationary phase. Expressions for problems with a two-dimensional initial profile are also reasonably wieldy. Two-dimensional and asymptotic three-dimensional numerical results are presented to second order in wave steepness. From these the nonlinear effects induced by the shear are investigated.

Andreas Akselsen
NTNU

Date submitted: 01 Aug 2017 Electronic form version 1.4