عنوان مقاله:

Linear and Weakly Nonlinear Models of Wind Generated Surface Waves in Finite Depth

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خلاصه مقاله:

This work regards the extension of the Miles' and Jeffreys' theories of growth of wind-waves in water of finite depth. It is divided in two major sections. The first one corresponds to the surface water waves in a linear regimes and the second one to the surface water waver considered in a weak nonlinear, dispersive and anti-dissipative regime. In the linear regime, we extend the Miles' theory of wind wave amplification to finite depth. The dispersion relation provides a wave growth rate depending to depth. A dimensionless water depth parameter depending to depth and a characteristic wind speed, induces a family of curves representing the wave growth as a function of the wave phase velocity and the wind speed. We obtain a good agreement between our theoretical results and the data from the Australian Shallow Water Experiment as well as the data from the Lake George experiment. In a weakly nonlinear regime the evolution of wind waves in finite depth is reduced to an anti-dissipative Kortewegde Vries-Burgers equation and its solitary wave solution is exhibited. Anti-dissipation phenomenon accelerates the solitary wave and increases its amplitude which leads to its blow-up and breaking. Blow-up is a nonlinear, dispersive and anti-dissipative phenomenon which occurs in finite time. A consequence of anti-dissipation is that any solitary waves' adjacent planes of constants phases acquire different velocities and accelerations and ends to breaking which occurs in finite space and in a finite time prior to the blow-up. It worth remarking that the theoretical amplitude growth breaking time are both testable in the usual experimental facilities. At the end, in the context of wind forced waves in finite depth, the nonlinear Schrödinger equation is derived and for weak wind inputs, the Akhmediev, Peregrine and Kuznetsov-Ma breather solutions are obtained.

کلمات کلیدی:

Surface waves, Wind waves, Interface waves, Rogue waves, Asymptotic models, Blow, Jeffreys' mechanism, up, Miles's mechanism