Flexural-gravity and capillary-gravity interfacial waves

Summary :

This thesis is devoted to the study of interfacial waves in two different problems.
The purpose of the first part is to study flexural-gravity solitary waves generated by a load moving on top of an ice sheet covering a water layer of finite depth. First of all, the experimental and linear results are shown. The nonlinear problem is first solved in the absence of load moving on the ice sheet. An analysis based on dynamical systems theory and on normal forms is used to study the deformations of the ice sheet. Solitary waves in the form of wave packets are computed. Numerical results based on the full equations are presented. Finally the load moving on the ice sheet is introduced again and for speeds close to the critical speed corresponding to the minimum of the dispersion curve, one finds that the solutions are adequately described by a forced nonlinear Schrödinger equation.
The second part deals with interfacial waves between two layers of fluid, when the upper layer is in contact with the air. After a study of the dispersion relation for the interfacial waves of gravity and capillarity-gravity, the normal form for a new case is given and the existence of solitary waves for the reduced system is analysed numerically. Then a numerical method based on the expansion in Fourier series of the physical variables in terms of the velocity potential is used to study periodic gravity waves which can appear. Generalized solitary waves, fast periodic waves and resonant periodic waves are presented.