Institut d'Analyse et Calcul Scientifique (IACS)
Section Mathématiques

SEMINAIRE D'ANALYSE

➢ *VENDREDI 21 novembre 2008 à 16h00 à la salle MA A331*

Professeur **Pietro BALDI** *(Università di Napoli - Italie)* donnera une conférence sur le thème:

"PERIODIC TRAVELLING WATER WAVES UNDER
NONLINEAR ELASTIC MEMBRANES"

"The talk is focused on a physical problem of interaction between hydrodynamics and the mechanics of nonlinear elastic bodies, which has been studied in two recent works with J.F. Toland.

In the first paper we consider the free boundary problem of travelling waves with steady periodic profile for a two-dimensional deep ocean in contact with an elastic membrane with nonlinear resistance to stretching, compression and bending. Adopting the mathematical formulation, developed by Babenko, Zakharov, Plotnikov, Buffoni, Shargorodsky and Toland, which uses holomorphic functions on the unit disc and Hilbert transform on the circle, the problem is reduced to one of maximizing a Lagrangian, and is tackled using direct variational methods. The dynamics equation on the free surface of the water is solved using an indirect strategy of Riemann-Hilbert type. The existence result is global (in the sense that the solutions are not of perturbation type).

In the second paper we study local bifurcation of periodic solutions of the same hydroelastic system, extended to include the inertial effects of the mass of the membrane. When the density of the membrane is a fixed positive constant, the wave velocity and the drift velocity of the membrane are the bifurcation parameters. Under certain hypotheses of non-resonance on the eigenvalues of the linearized problem, we prove the bifurcation of two sheets (i.e. 2-dimensional manifolds) of nontrivial "special" solutions (primary bifurcation), from which a third sheet of "general" solutions branches (symmetry-breaking secondary bifurcation). This phenomenon is a hydroelastic analogous to that of Wilton ripples, which arises in the classical water-wave problem when the surface tension has special values."

Lausanne, octobre 2008
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