SEMINARIO DE ANÁLISIS Y APLICACIONES

Viernes, 20 de mayo de 2011

11:30 h., Módulo 17 (antiguo C-XV) - Aula 520 (Depto. Matemáticas UAM)

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Isoperimetric inequalities and cavity interactions in nonlinear elasticity

Resumen: *Joint work with Sylvia Serfaty (LJLL, Université Paris VI).*

We consider the problem of cavitation in nonlinear elasticity, or the formation of macroscopic cavities in elastic materials from microscopic defects, when subjected to large tension at the boundary. The main goal is to determine the optimal locations where the body prefers the cavities to open, the preferred number of cavities, their optimal sizes, and their optimal shapes. To this aim it is necessary to analyze the elastic energy of an incompressible deformation creating multiple cavities, in a way that accounts for the interaction between the cavitation singularities. Based on the quantitative version of the isoperimetric inequality, as well as on new explicit constructions of incompressible deformations creating cavities of dfferent shapes and sizes, we provide energy estimates showing that, for certain loading conditions, there are only the following possibilities:

- only one cavity is created, and if the loading is isotropic then it is created at the centre
- multiple cavities are created, they are spherical, and the singularities are well separated
- there are multiple cavities, but they act as a single spherical cavity, they are considerably distorted, and the distance between the cavitation singularities must be of the same order as the size of the initial defects contained in the domain.

In the latter case, the formation of thin structures between the cavities is observed, reminiscent of the initiation of ductile fracture by void coalesence.