SEMINARIO DE ANÁLISIS Y APLICACIONES

Viernes, 18 de marzo de 2011

11:30 h., Aula Naranja (ICMat, Campus de Cantoblanco)

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Fluid accumulation regions in thin-film flows driven by surface tension and gravity

Resumen: *Joint work with J.J. López Velázquez.*

We study two-dimensional thin-films going down a surface due to both the actions of gravity and of the curvature of the substrate. The model can be simplified by employing a lubrication approximation for very viscous flows (valid when the fluid motion is so slow that inertia terms are neglected, and the height of the fluid is small compared to the characteristic curvature of the substrate). This asymptotic approximation gives a hyperbolic equation with a small control parameter multiplying a third order term, where the unknown is the height of the fluid measured from the substrate and the small parameter is the height-curvature ratio. The interplay between gravity and curvature in the equation appears at leading order and is given by a driving term that measures the tendency of the fluid to move in the direction tangent to the substrate. The leading order stationary equation suggests, in particular, that at regions where this term vanishes the fluid accumulates breaking down the approximation. We analyze the case where this term is nearly constant and vanishes quadratically near some points. This assumption results in a non-autonomous third order ordinary differential equation, and we show that solutions satisfying the corresponding matching conditions near the point of vanishing can be constructed. These solutions are the natural candidates to describe fluid accumulation within the lubrication approximation framework.

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