THE CRM APPLIED MATHEMATICAL AND PHYSICS (CAMP) SEMINARS

CENTRE DE RECERCA MATEMÀTICA

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Asymptotic, numerical and approximate results for spherical Stefan problems

Abstract:

In this work we begin by analysing the inward melting of a spherical ball of ice. The simplest model to describe this is the classic one-dimensional spherical Stefan problem. Similar to the classic Stefan problem, the region initially has zero thickness and so must be analysed carefully before performing a numerical computation in order to give the correct starting solution. This is incorporated into the second order accurate Keller box finite difference scheme, which is shown to be compact and easy to implement. We will discuss expansions in the small-time and large Stefan number limit using a generalised approach which allows higher order terms to be determined in a systematic way. In addition, we will apply the combined integral method (CIM) to this problem, which is a refinement of the popular heat balance integral method (HBIM), and compare both the CIM and asymptotic solutions to the numerical results. This problem differs from the classic planar Stefan problem by having an "extinction time" which occurs when all the ice has melted. We will briefly discuss how the methods above deal with this extra complication.

If time allows, we will also consider a related model describing solvent-dependent drug diffusion through polymeric spheres and describe the similarities and differences between this and the classic spherical Stefan problem.

Date:	**December 5th, 2013**
Place:	**Room C1/028**
Time:	**12:00**