# Applied Mathematics

## McGill & CRM Applied Mathematics Seminar

**2:35 pm Monday 19th April 2004**
**At McGill, Burnside Hall 1205**

### "Thermal stress and defects inside a single crystal grown by the Czochralski technique"

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*Coffee and refreshments will be served after the seminar*

**Abstract**: In this talk I will describe the basic idea of a semi-analytical approach for computing the temperature and thermal stress inside a a single crystal grown with the Czochralski technique. An analysis of the growing conditions indicates that the crystal growth occurs on the conductive time scale. A perturbation method for the temperature field is developed using the Biot number as a (small) expansion parameter whose zeroth order solution is one-dimensional (in the axial direction) and is obtained for a cylindrical and a conical crystal. Under typical growth conditions, a parabolic temperature profile in the radial direction is shown to arise naturally as the first order correction. As a result, the thermal stress is obtained explicitly and its magnitude is shown to depend on the zeroth order temperature and Biot number. A number of applications using the semi-analytical model will be discussed.

Joint work with: S. Bohun, I. Frigaard, S. Liang, N. Vaidya and D. Liang
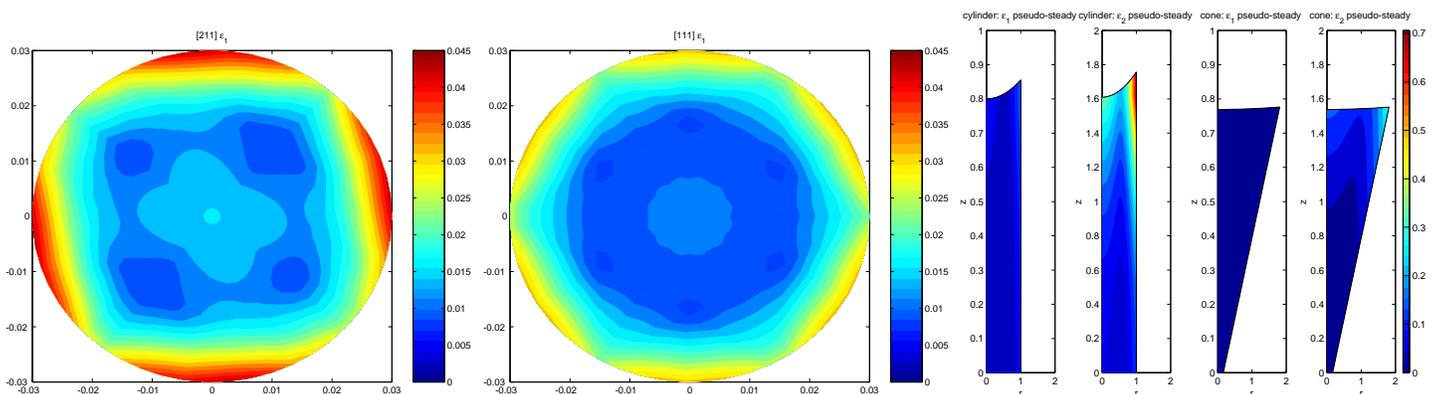
Stress contours in the cross section of cylindrical crystals grown in the $\langle 111 \rangle$ and $\langle 211 \rangle$ directions and stress contours in the r-z plane assuming axisymmetry, for cylindrical and conic crystals under two different growing conditions.