PHYSICAL MATHEMATICS SEMINAR

Crystal Cutting and Radiative Moment Closures by Optimal Prediction

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ABSTRACT:

The method of optimal prediction approximates a large system by a smaller one. More precisely, the average solution of a complex system with respect to a measure is sought. For instance, in weather forecast, one can be interested in the average temperature in an ensemble of many possible tomorrows. The Mori-Zwanzig formalism applied to conditional expectations replaces the influence of the averaged unknown of the large system by a memory term.

We present two applications, for which optimal prediction successfully truncates a large system. In molecular dynamics, a large crystal is replaced by a smaller one. Optimal prediction yields a boundary layer condition that acts as if the crystal were continued to infinity, at least in equilibrium.

In the kinetic equations of radiative transfer, an infinite moment system has to be truncated. Various closures exist to incorporate the dynamics of the high moments on the ones of interest. An extension of optimal prediction to partial differential equations admits the re-derivation, and thus a new understanding, of existing moment closures. In addition, new types of closure strategies can be derived. A particular example is crescendo-diffusion, which comes at no extra cost, but improves computational results.

TUESDAY, FEBRUARY 24, 2009
2:30 PM
Building 2, Room 105

Refreshments at 3:30 PM in Building 2, Room 349
(Applied Math Common Room)

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