

THE MATHEMATICS DEPARTMENT PRESENTS

A MATHEMATICS COLLOQUIUM

THURSDAY, October 11, 2007

BOND HALL 227

4:00 pm

Title: SINC-PACK and Separation of Variables

Speaker: Frank Stenger, SINC, LLC and University of Utah (retired)

Abstract: This talk consists of mathematical parts of Stenger's SINC-PACK computer package (an approx. 450-page tutorial + about 250 MATLAB programs), for carrying out solutions to computational problems via use of SINC methods.

Some examples illustrating computer solutions via SINC-PACK will nevertheless be given in the talk. In one dimension, SINC-PACK enables the following, over finite, semi-infinite, infinite intervals or arcs: interpolation, differentiation, definite and indefinite integration, definite and indefinite convolution, Hilbert and Cauchy transforms, inversion of Laplace transforms, solution of ordinary differential equation initial value problems, and solution of convolution-type integral equations. The methods of the package are especially effective for problems with (known or unknown - type) singularities, for problems over infinite regions, and for PDE (partial differential equation) problems.

In more than one dimension, the package enables solution of linear and nonlinear elliptic, hyperbolic, and parabolic PDE, as well as of integral equation and conformal map problems, via use of relatively short programs that use the above one-dimensional methods. The regions for these problems can be curvilinear, finite, or infinite. Solutions are UNIFORMLY accurate, and the rates of convergence of the approximations of SINC-PACK are always EXPONENTIAL.

In Vol. 1 of their 1953 text, Morse and Feshbach prove for the case of 3-dimensional Poisson and Helmholtz PDE that separation of variables is possible for essentially 13 different types of coordinate systems. A few of these (rectangular, cylindrical, spherical) are taught in our undergraduate engineering-math courses. It is demonstrated in the talk that one can ALWAYS achieve separation of variables via use of SINC-PACK, under the assumption that calculus is used to model the PDE.

Refreshments will precede the talk at 3:30pm in Bond Hall 300
courtesy of Yun-Qiu Shen.