The Nuclear Science and Technology Division

SEMINAR ANNOUNCEMENT

The Quasidiffusion Method for Transport Problems on Unstructured Meshes of Quadrilaterals in Cartesian XY Geometry

William Wieselquist

Monday, April 28, 2008
10:00 a.m.
Bldg. 5700, O304 Conference Room

In this talk, we present a quasidiffusion (QD) method for solving the transport equation in 2D Cartesian geometry on unstructured spatial meshes of arbitrary quadrilaterals. The QD method has been used to solve neutron, photon, and electron transport problems in reactor physics, radiative transfer, and atmospheric physics.

The QD equations consist of coupled high-order and low-order equations, namely the transport equation and the so-called low-order quasidiffusion (LOQD) equations.
The LOQD equations form a non-self-adjoint elliptic system of equations for the scalar flux (intensity) and current (flux). Mathematically, the LOQD equations resemble convection diffusion equations with a diffusion tensor, although the LOQD equations contain extra ``cross-derivative'' terms which make robust discretization of the LOQD equations much more difficult.

In our method, to discretize the high-order transport equation we have used short, long, and subcell (slice) balance characteristic methods. For the LOQD equations, we have developed an entirely new discretiziation. We present computational results of the new method on randomized and hanging-node meshes to demonstrate its excellent performance.