Martin F. Staley

Los Alamos National Laboratory

Education

Graduate studies in Applied Mathematics, University of Arizona (1991-1993).

M.S. in Applied Mathematics, University of Arizona (1991).

B.S. in Engineering Mathematics, University of Arizona (1989).

Selected Professional Experience

2/93-present: Technical Staff Member, Mathematical Modeling and Analysis Group (T7), Los Alamos National Laboratory. Designed, coded, tested, and documented PDE-solving, I/O, graphics, remapping, and miscellaneous mathematical and scientific software. C++, C, and Fortran. Interfaced codes to software packages including AVS, IDL, NCAR-graphics, and Matlab.

Summers '91, '90, '89: Software Engineer, Lunar and Planetary Laboratory, University of Arizona. Designed, coded, tested, and documented complete software package, with graphical user interface, for controlling charged-couple device (CCD) camera and telescope, and for reading, processing, displaying and analyzing data and images. C and Assembly.

Research Interests

Primary research interests are in developing software for scientific applications.

Selected Recent Software Projects

Conservative Remapper (CORE)

CORE is a new C++ library for performing conservative remaps, which we define as transferring cell values of a discrete function between two close grids with the same connectivity. CORE supports two-dimensional unstructured grids and runs on both serial and parallel machines. It supports two remapping algorithms ("swept region" and "exact intersection"), as well as Cartesian and cylindrical coordinates, remapping of single or multiple quantities, and much more.

Templated PDE Toolbox (TPT)

TPT is a large, modern C++ library for helping researchers solve PDEs. It contains C++ classes and functions for handling initial and boundary conditions; one-, two-, and three-dimensional uniform, orthogonal, and irregular grids and functions; same-type or polymorphic groups of objects (comprising, for example, the dependent variables in a system of PDEs); a variety of schemes for numerical differentiation and integration; an interface to Matlab; and much more. The library contains implementations of new, high-quality compatible differencing schemes, for which the discrete versions of operators such as divergence, gradient, and curl satisfy certain properties of their continuous analogs.

DFTmod Library

DFTmod contains Fortran subroutines for calculating quantities related to discrete Fourier transforms. Included are routines for dealing with real, complex, half-wave sine, half-wave cosine, quarter-wave sine, and quarter-wave cosine transforms. For each of the transform types are several dozen built-in filters, for taking spectral derivatives and integrals; low-passing and high-passing the data; calculating gradient and divergence; performing Hilbert transforms; exponentiating the filter matrix (to assist users in solving linear equations exactly using spectral methods, or in building split-step numerical integration schemes); applying ramp filters, mode limiting filters, etc. Filters can be expressed using a special notation and combined via arithmetic expressions to construct compound filters. C and C++ interfaces to DFTmod are available, as is a user manual.