

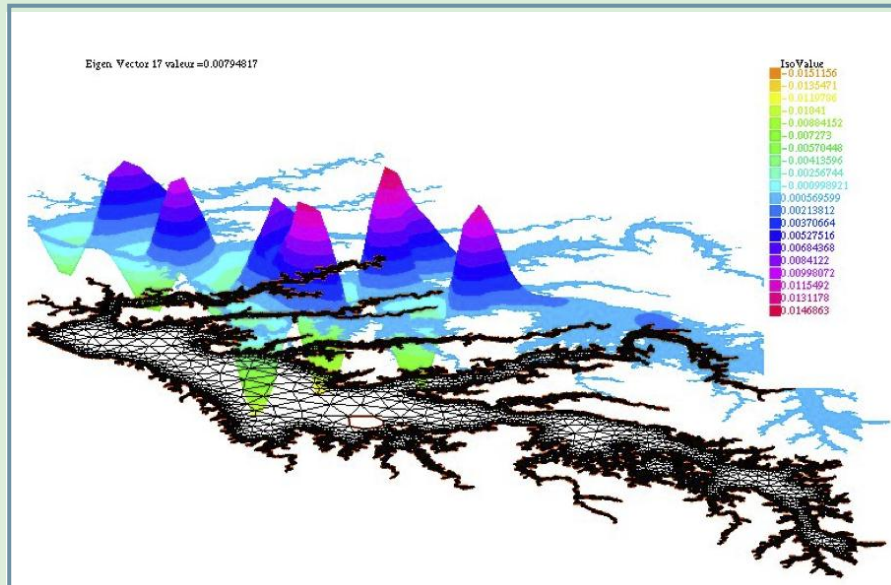
Learn to use the General Purpose User Friendly PDE Solver

freefem++

<http://www.freefem.org/ff++>

FEBRUARY 8-9, 2013

MATH. DEPT. UNIVERSITY OF HOUSTON



Frédéric HECHT and Olivier PIRONNEAU



The authors of Freefem++v3 will cover the essentials of the software's capabilities, from simple equations and systems such as Laplace or Lamé equations to coupled nonlinear 3D multi-physics problems using exotic finite element method and parallel linear solvers.

Freefem++ is user friendly with an instantaneous learning curve; it has its own language close to math, such as

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solve a(u,v)=int2d(Omega) (dx(u)*dx(v)+dy(u)*dy(v)) +on(gamma,u=1) ;
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and its own graphics; it is an ideal tool for teaching numerical methods for PDE's and it is also very convenient for prototyping new ideas at a research level.

Lectures in the mornings will be followed by tutorials in the afternoons. The following topics will be covered: automatic mesh generation and adaptation, Poisson, Stokes, Maxwell, Boussinesq and Navier-Stokes equations. Applications to structures, fluids, thermodynamics, acoustics, waves and coupled and/or time dependent problems with moving domains; optimization, control and optimal shape design. Domain decomposition and solution on a parallel computer using embedded mpi. Most of the above can be done in 3D. Among all existing FEM, a large number of them are implemented, but only on triangles/tetrahedra. It runs on PC, Mac and Linux.



Program

February 8, Friday

10:00AM – 11:40AM : Introduction (by Olivier Pironneau)

Basic syntax of freefem++ ; history, the 3 main building blocks, mesh generation and adaptation. Some hints on the internal structure of freefem++.

1:00AM – 2:40PM : Lecture 1 (by Frédéric Hecht)

Structure mechanics with freefem++ :

Laplace, Lamé, and eigen modes. Introduction to 3D problems.

3:00PM – 5:00PM : Tutorial 1 (by Frédéric Hecht and Olivier Pironneau)

Installation on a PC. Some basis examples; Mesh generation and mesh adaptation ; a minimal surface problem. Sample problems to try at home.

February 9, Saturday

10:00AM – 11:40AM : Lecture 2 (by Olivier Pironneau)

Fluid Mechanics with freefem++

Flow through porous media, convection – diffusion problems (including DG methods).

Navier-Stokes and Shallow water equations. Optimization and control problems.

1:00AM – 2:40PM : Lecture 3 (by Frédéric Hecht)

Advanced technique

Problems using complex numbers. More 3D problems. Linear and non-linear solvers.

Parallelization by domain decomposition, Non-standard Finite Elements.

3:00PM – 5:00PM : Tutorial 2 (by Frédéric Hecht and Olivier Pironneau)

Each participant will choose a problem from the list and will try to solve it, assisted by Frédéric Hecht and Olivier Pironneau.

Prerequisites

Participants are expected to have the basic knowledge of variational formulations and the finite element method. No prior knowledge about linear solvers or programming (matlab type) is needed, but it can help.

Participants **should come with their own PC** (Mac OSX 10.6 or above, Windows XP or above, Lunux Debian/ubuntu, others need recompilation of the source code).

Registration

Participants are required to register by sending to kikinzon@math.uh.edu the following information:

1. Your name;
2. Affiliation and position (e.g., UH, Department of Mathematics, Graduate student);
3. Contact e-mail.

Any additional information and possible changes will be communicated to the registered participants via the contact e-mail provided at the time of registration.