香港浸會大學
HONG KONG BAPTIST UNIVERSITY

Department of Mathematics

Distinguished Lecture Series

Eikonal Equation: An Elliptic Solver Approach

Professor Roland Glowinski

Cullen Professor of Mathematics, University of Houston
Member of the French National Academy of Sciences
SIAM Fellow
Member of Academia Europaea
SIAM Von Karman Prize
CFD Award of the American Association for Computational Mechanics
Emeritus Professor, University P. & M. Curie, Paris, France
Honorary Professor, Fudan University, Shanghai

Date: **7 January 2014 (Tuesday)**

Time: **11:00am - 12:00noon** (Preceded by Reception at 10:30am)

Venue: **RRS905, Sir Run Run Shaw Building,**
Ho Sin Hang Campus,
Hong Kong Baptist University

Abstract

The main goal of this lecture is to discuss the numerical solution of the Dirichlet problem for the *Eikonal equation*

(EKN) $$\begin{cases} |\nabla u| = 1 \text{ in } \Omega, \\ u = g \text{ on } \partial\Omega, \end{cases}$$

where Ω is a bounded domain of $\mathbf{R}^2$. Traditionally, the equation $|\nabla u| = 1$ is considered as a nonlinear hyperbolic one leading to numerical methods taking advantage of this hyperbolic feature. Motivated by the numerical solution of systems of the form

$$\nabla \mathbf{u}(x) = O(d),$$

completed by boundary conditions (with $O(d)$ the group of the $d \times d$ orthogonal matrices), a problem considered by B. Dacorogna, we have investigated the solution of (EKN) through the use of finite elements and elliptic solvers. The main idea is to approximate (EKN) by a problem of Calculus of Variations involving a Ginzburg-Landau nonlinearity and a bi-harmonic regularization (linear or nonlinear). Next, a well-chosen initial value problem associated with the Euler-Lagrange equation of the above variational problem is solved by an operator-splitting method decoupling differential operators and nonlinearity. Assuming that (EKN) has multiple solutions, the above approach allows to compute at will the maximal or the minimal solution of (EKN). This approach is easy to implement via piecewise linear approximations, ideally suited to capture the solutions of this problem, and as such is easy to implement for domains Ω of arbitrary shape, including therefore curved boundaries. The results of numerical experiments will be presented.

✦ ✦ ✦ **All are welcome** ✦ ✦ ✦

For enquires please contact Ms. Claudia Chui, 3411 2348.

http://www.math.hkbu.edu.hk/