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香港浸會大學
HONG KONG BAPTIST UNIVERSITY

Institute for Computational Mathematics Lecture Series

Matrices, Moments and Quadrature

Speaker : Professor Gerard Meurant

Commissariat a l'Energie Atomique
CEA/DIF, France

Venue : FSC1217, Fong Shu Chuen Library, HSH Campus, Hong Kong Baptist University

	Date	Time
Lecture 1	8 October 2008 (Wednesday)	2:00 p.m. - 3:30 p.m.
Lecture 2	10 October 2008 (Friday)	2:00 p.m. - 3:30 p.m.
Lecture 3	15 October 2008 (Wednesday)	2:00 p.m. - 3:30 p.m.
Lecture 4	17 October 2008 (Friday)	2:00 p.m. - 3:30 p.m.

Abstract:

The aim of this series of lectures is to describe and explain the beautiful mathematical relationships between matrices, moments, orthogonal polynomials, quadrature rules and the Lanczos and conjugate gradient algorithms. The main topic is to obtain numerical methods to estimate or in some cases to bound quantities like $I[f] = u^T f(A)v$ where u and v are given vectors, A is a symmetric nonsingular matrix and f is a smooth function.

There are many instances in which one would like to compute bilinear forms like $u^T f(A)v$. A first application is the computation of some elements of the matrix $f(A)$ when it is not desired or feasible to compute all of $f(A)$. Computation of quadratic forms $r^T A^{-i} r$ for $i = 1, 2$ is interesting to obtain estimates of error norms when one has an approximate solution of a linear system $Ax = b$ and r is the residual vector $b - Ax$.

Bilinear or quadratic forms arise naturally for the computation of parameters in problems like least squares, total least squares and regularization methods for solving ill–posed problems.

We will describe the algorithms and give some examples of applications. The contents of the lectures are the following.

- Orthogonal polynomials and properties of tridiagonal matrices.
- The Lanczos and conjugate gradient (CG) algorithms and computation of Jacobi matrices
- Gauss quadrature and bounds for bilinear forms $u^T f(A)v$
- Applications:
  - Bounds for elements of $f(A)$,
  - Estimates of error norms in CG,
  - Least squares and total least squares,
  - Discrete ill–posed problems.

- All interested are welcome –

For further information, please visit **http://www.math.hkbu.edu.hk/ICM/lectures**, or call 34115056.