SYSC5906 - Directed Studies
(Distributed Sparse Matrices)

Alistair Boyle 2010

Overview

- Course Outline

- Background

- Scheduling

a Plan

- Building blocks
  - Matrix types (dense, banded, triangular, sparse*)
  - Generalized problems, solution techniques
- Sparse matrices: storage, operations, ordering
- Distributed matrix computations
  - Shared memory vs. Heterogeneous:
    - (optimal) partitioning, ordering
- Sparse & distributed

Course Outline

1. Identify the literature of distributed sparse matrices (see reading list) – Sept 15

2. Identify toolkits for distributed sparse matrices (see reading list) – Sept 15

3. Understand how distributed sparse matrix solvers work and write a report about distributed sparse matrices – Oct 20

4. Build a test framework for distributed sparse matrices and test for various solvers – Oct 30

5. Build an interface to Octave and/or Matlab to interface to distributed sparse solvers – Nov 30

[extracted from course outline]

Project

- Midterm Report: Review of Distributed Sparse Solver Toolkits

- Project Report & Presentation: Testing Framework and Interface to Octave (or MatLab)

Basic Linear Algebra Subprograms (BLAS)

- Basic matrix operations
  - L1 - vector-vector operations
  - L2 - matrix-vector operations
  - L3 - matrix-matrix operations
- Optimizations for
  - Dense, banded, triangular
  - NOT sparse

FORTRAN & C

Linear Algebra PACKage (LAPACK)

- Builds upon BLAS
- Solvers:
  - Linear Least Squares
  - Generalized Least Squares (find the min)
  - Eigenproblems (find the resonant frequencies)
- Factorization, Decomposition
  - OR, LQ, QR* (min norm), Complete Orthogonal, RQ
  - SVD, Schur compliments

FORTRAN

Sparse Matrices

Sparse Matrices

- Storage

  - (row, column) = value

  - compressed column/row format

    - Linear algebra solvers after performing reordering to optimize sparsity

      - AMD, METIS, CHOLMOD, UMFPACK

Distributed

- Shared memory (OpenMP), or
- Heterogeneous (MPI based)

http://www.flickr.com/photos/mattwright/1787856/

Schedules

- Alistair: Class Tue/Thurs 11:30-1pm

- Dr. Adler?

- Dr. Green?

Questions?