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MA/CSC 583

Introduction to Parallel Computing

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Time: Spring 2012, Tu. and Th. at 8:05-9:20

Place: SAS 2102

Introduction to basic parallel architectures, algorithms and programming paradigms; message passing collectives and communicators; parallel matrix products, domain decomposition with direct and iterative methods for linear systems; analysis of efficiency, complexity and errors; applications such as 2D heat and mass transfer.

The first half of the course will introduce the basic message passing interface (MPI) subroutines. The second half will use MPI to solve linear systems via direct and minimized iterative methods. Accounts on current multiprocessing computers will be provided.

Students completing this course will be able to: (1) understand the message passing subroutines for parallel computations; (2) implement and execute message passing codes related to matrix products; (3) approximate the solutions of linear algebraic systems via domain decomposition, conjugate gradient and generalized minimum residuals; (4) use message passing for modeling significant applications.

Prerequisites:

CSC 302 or MA 402 or MA/CSC 428 or MA/CSC 580.

Assignments and Grading:

Homework Sets:	50%
Course Projects:	50%

Suggested Texts:

[Parallel Programming with MPI](#) ?????
by Peter Pacheco, published by Morgan Kaufmann

[Computational Mathematics: Models, Methods and Analysis with Matlab and MPI](#) by Robert E. White, published by CRC Press



Lecture	Date	Section	Topics
1	1-10-12	notes	Intro. to parallel programming
2	1-12-12	4.6	Reordering schemes
3	1-17-21	6.1	Vector pipes
4	1-19-12	6.2	Matrix-vector products
5, HW1	1-24-12	6.3	Multiprocessors
6	1-26-12	6.4	Basic MPI
7	1-31-12	6.5	Matrix products and MPI
8, HW2	2-2-12	6.6	Explicit methods and MPI
9	2-7-12	notes	Multicore
10	2-9-12	notes	Open MP
11	2-14-12	notes	MPI with Open MP
12, HW3	2-16-12	7.1, 7.2	Reduce and broadcast
13	2-21-12	7.3, 7.4	Gather and scatter
14	2-23-12	7.5	Communicators
15, HW4	2-28-12	7.6	Fox algorithm
16	3-1-12	8.1	Gauss Elmin.
17	3-13-12	8.2	SPD matrices
18, HW5	3-15-12	8.3	Domain Decomp. and MPI
19	3-20-12	8.4	P-regular splitting
20	3-22-12	8.5	SOR and MPI
21, HW6	3-27-12	8.6	Parallel ADI
22	3-29-12	3.5	Steepest descent
23	4-3-12	3.6	Conjugate directions
24	4-10-12	9.1	CG and Krylov vectors
25	4-12-12	9.2	Par. Preconditioners
26, HW7	4-17-12	9.3	PCG and MPI
27	4-19-12	9.4	Least Squares
28	4-24-12	9.5	GMRES
29, HW8	4-26-12	9.6	GMRES(m) and MPI