Second Announcement and Registration Form

CONFERENCE ON ITERATIVE METHODS FOR LARGE LINEAR SYSTEMS

October 19,20, and 21, 1988

The University of Texas at Austin

Celebrating the 65th birthday of David M. Young, Jr.

OBJECTIVE: This conference will be dedicated to providing an overview of the state of the art in the use of iterative methods for solving sparse linear systems with an eye to contributions of the past, present, and future. The emphasis will be placed upon identifying current and future research directions in the mainstream of modern scientific computing. Recently, the use of iterative methods for solving linear systems has experienced a resurgence of activity as scientists attack extremely complicated three dimensional problems using vector and parallel supercomputers. Many research advances in the development of iterative methods for high-speed computers over the past forty years will be reviewed as well as focusing on current research.

INVITED SPEAKERS:

L. Adams (Washington University)
O. Axelsson (University of Nijmegen, Netherlands)
G. Birkhoff (Harvard University)
P. Concus (Lawrence Berkeley Laboratory)
L. Ehrlich (John Hopkins University)
H. Elman (University of Maryland)
G. Golub (Stanford University)
L. Hageman (Bettis Atomic Power Laboratory)
R. Lynch (Purdue University)
T. Manteuffel (Los Alamos National Laboratory)
J. Ortega (University of Virginia)
J. Rice (Purdue University)
P. Saylor (University of Illinois)
R. Varga (Kent State University)
W. Wachspress (University of Tennessee)
M. Wheeler (Rice University)
O. Widlund (Courant Institute)
D. Young (University of Texas)

ORGANIZATIONS: The host organization is the Center for Numerical Analysis (CNA) of The University of Texas at Austin. The members of the local organizing committee are D. Kincaid, L. Hayes, G. Carey and W. Cheney. The conference is being co-sponsored by the Special Interest Groups for Linear Algebra and Supercomputing of the Society for Industrial and Applied Mathematics.

ACCOMMODATIONS: To make reservations call the Austin Marriott at the Capital [(512) 478-1111 or (800) 228-9290] or mail the enclosed card for rooms at the special conference rate of $55 for single or double rooms. All reservations are handled on a first-come-first-served basis. Reservations must be received by October 4, 1988. Reservations made after this date are subject to guest room availability.

REGISTRATION: Conference advanced registration fee is $95 (SIAG/LA or SIAG/SC members $85), if received by September 1, 1988. If paid after this date or at the conference, the registration fee is $125. This fee includes morning and afternoon coffee breaks, a reception, a banquet honoring Professor Young, and other activities. The student registration fee is $15 which allows admission to the technical sessions and coffee breaks only. To register, detach and mail the registration form below. For additional information, contact the CNA at the address below or at Tel: (512) 471-1242 ; Arpanet: sheri@sally.utexas.edu; Bitnet: sheri@uta3081.

Mrs. Katy Burrell
Conference Secretary
Center for Numerical Analysis
RLM Bldg 13.150
University of Texas at Austin
Austin, Texas 78713-8510

(detach and mail)

Presented at the Conference on Iterative Methods For Large Linear Systems, Univ. of Texas, Austin, October 19-21, 1988

DISTRIBUTED MINIMAL RESIDUAL (DMR) METHOD FOR EXPLICIT ALGORITHMS APPLIED TO NONLINEAR SYSTEMS

Seungsoo Lee, Graduate Assistant

George S. Dulikravich, Associate Professor

Daniel J. Dorney, Graduate Assistant

Department of Aerospace Engineering
Pennsylvania State University, University Park, PA 16802

ABSTRACT

A new algorithm for the acceleration of explicit iterative schemes for the numerical solution of nonlinear systems of partial differential equations has been developed. The method is based on the idea of allowing each partial differential equation in the system to approach the converged solution at its own optimal speed. The DMR (Distributed Minimal Residual) method introduces a separate sequence of optimal weighting factors to be used for each component of the general solution vector. The acceleration scheme was applied to a highly nonlinear coupled system of four time-dependent partial differential equations of inviscid gasdynamics in conjunction with the finite volume Runge-Kutta explicit time-stepping algorithm. Using DMR without multigridding, between 30% and 70% of the total computational efforts were saved in the subsonic compressible flow calculations. DMR method offers most time savings when applied to stiff systems of equations.

Several attempts have been made to accelerate the iterative convergence of this method. They include local time stepping, implicit residual smoothing, enthalpy damping and multigrid techniques. Also, an extrapolation procedure based on the power method and the Minimal Residual Method (MRM) were applied to the finite volume Runge-Kutta method. In the MRM, a weighted combination of the corrections at consecutive iteration levels is extrapolated and the weights are chosen to minimize the L_2 norm of the future residual. The extrapolation was performed without considering the properties of the governing equations. The GNLMR (Generalized Non-Linear Minimal Residual) method utilizes the information about the governing equations. It has been applied successfully to a number of scalar nonlinear partial differential equations.

Both MRM and GNLMR method are based on using the same values of optimal weighting factors for the corrections to every equation in a system. Since each component of the solution vector in a system of equations has its own convergence speed, the sequence of optimal weights could be allowed to be different for each component. This concept is the essence of the DMR method. Thus, for example, we combined corrections from four consecutive time steps by introducing four weighting factors to each of the four equations. Hence, a set of sixteen algebraic equations needs to be solved to determine the four sequences of four weighting factors in each of them. The DMR method requires about 200% more storage than the original non-accelerated algorithm.