AEC-NASA TECH BRIEF

Computer Subroutine ISUDS Accurately Solves Large System of Simultaneous Linear Algebraic Equations

The problem:

The accuracy of a solution for a set of simultaneous equations decreases as the order of the system increases. A computer program is required that can obtain double-precision accuracy while using a single-precision coefficient matrix to conserve memory storage.

The solution:

A computer program, an Iterative Scheme Using a Direct Solution (ISUDS), which obtains double precision accuracy using a single-precision coefficient matrix.

How it's done:

ISUDS finds a solution to a system of equations and increases its accuracy while using a single precision coefficient matrix. The equations are written in matrix form as $AX=B$, where A is a square non-singular coefficient matrix, X is a vector, and B is a vector. The values of X that are found are substituted into the equations and the residuals are calculated, using double-precision arithmetic.

The system of equations is then solved again, except with the residuals of the equations as the right-hand sides. The first solution (X_1) satisfies the equations with the right-hand side equal to the vector B, minus the residuals R, while the second solution (X_2) satisfies the same system with the residuals on the right-hand side. Hence, X_1+X_2 satisfies the same system of equations, and since $(B-R)+R=B$, the sum of X_1+X_2 will give an accurate solution to $AX=B$. A solution to any desired accuracy may be obtained on a digital computer, depending on the word size.

Notes:

1. The digital computer code ISUDS is written in Fortran IV language for use on the IBM 7094 and is based on the use of ISIMEQ, a 7094 Fortran simultaneous linear equation subroutine. A storage capacity of approximately 32K is required.
2. Inquiries concerning this program may be directed to:

   COSMIC
   Computer Center
   University of Georgia
   Athens, Georgia 30601
   Reference: B67-10344

Patent status:

No patent action is contemplated by AEC or NASA.

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