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.

Source: George Collier of Westinghouse Astronuclear Laboratory under contract to AEC-NASA Space Nuclear Propulsion Office (NUC-10051)