6.0-1

Section 6
DIFFERENCES BETWEEN THE EISPACK SUBROUTINES AND THE HANDBOOK ALGOL PROCEDURES

This section describes, subroutine by subroutine, the major differences between the EISPACK subroutines and their Algol antecedents in the Handbook [1]. These differences fall into four categories: 1) correction of several errors, 2) minor algorithmic improvements, 3) changes based on consideration of Fortran language efficiency, and finally, 4) changes to better unify the individual programs into a package.

Some of the changes apply to EISPACK as a whole.

1) The base B of the floating point representation on the machine and the machine precision MACHEP have become internally set variables in the Fortran programs rather than parameters.

2) The orthogonality threshold parameter TOL has been removed from the Householder reduction subroutines by substituting the alternate scaling technique discussed in the "Organisational and Notational Details" section of the Handbook, Contribution II/2, p. 221.

3) The procedure CDIV called to perform complex division in the Handbook procedures has been replaced by ordinary division operations with complex-mode Fortran operands. The procedures CABS and CSQRT called to perform complex modulus and complex square-root operations have been replaced by references to corresponding members of the Fortran library which use complex-mode operands.

4) The Handbook procedure-calls for row interchange in the balancing process, for determination of Sturm counts in the bisection process, and for selection of new trial vectors in the inverse iteration process have been replaced by in-line Fortran coding.
Specific changes to individual members of EISPACK are as follows.

BALANC - IGH=1 rather than IGH=0 is returned when the matrix can be permuted to triangular form; IGH is used as an array declarator subscript in other subroutines and must not be "0".

TRED1 - Unnecessary operations in the last reduction step that can introduce roundoff error into the first diagonal element have been skipped, enabling the resultant tridiagonal form to more literally duplicate that from TRED2. Also see TRED2 below.

TRED2 - The arithmetic operation \( G^*(Z/H) \) is computed instead as \( (G/H)\*Z \), enabling the resultant tridiagonal form to more literally duplicate that from TRED1. The tridiagonal forms from TRED1 and TRED2 are now identical (on most machines) except possibly for the sign of the first subdiagonal element. This property in turn ensures that TQL1 and TQL2, or IMTQL1 and IMTQL2, produce identical eigenvalues in most cases.

TRBAK1 - Instead of back transforming eigenvectors M1 through M2 as is done in the Handbook, TRBAK1 transforms eigenvectors 1 through M. (The M1, M2 form of specification would be more natural if subroutine BISECT were patterned after the Handbook BISECT rather than the Handbook TSTURM.)