



## **GDD-8000 Extended C Callable EISPACK LINEAR EIGENVALUE/EIGENVECTOR SYSTEMS PACKAGE for TMS320C6000.**

The library is a set of about 100 functions and macros that find a solution to a linear algebraic eigensystems with various matrices, real or complex, general, band, symmetric or Hermitian. All or selected eigenvalues and eigenvectors can be computed. Several types of matrix decompositions like SVD or QR are performed by the library functions.

A set of memory allocation functions provides with economical storage for general/structured matrix classes. By using these memory allocation routines the amount of RAM storage is minimized for structured types of matrices, like symmetric, band and triangular classes of matrices.

The library implements and make use of complete Level 1 BLAS (Basic Linear Algebra Subroutines) standard.

Library's functions have been optimised algorithmically at the assembly level to fully utilize advantages of TMS320C6000 parallel architecture, floating point arithmetic and pipeline. BLAS Level 1 functions are hand-coded in assembly to obtain maximum possible performance of the TMS320C6000 DSPs.

The user's manual gives the details on using library functions.

### **FUNCTIONS**

- **REAL GENERALIZED EIGENSYSTEMS**
  - QZAB Find Generalized Eigenvalues and Eigenvectors
  - RGG Find Generalized Eigenvalues and Eigenvectors
  
- **REAL SYMMETRIC GENERALIZED EIGENSYSTEMS**
  - RSG Find Generalized Eigenvalues and Eigenvectors
  - RSGAB Find Generalized Eigenvalues and Eigenvectors
  - RSGBA Find Generalized Eigenvalues and Eigenvectors
  
- **REAL GENERAL EIGENSYSTEMS**
  - RG Find Eigenvalues and Eigenvectors
  
- **REAL SYMMETRIC EIGENSYSTEMS**
  - RS Find Eigenvalues and Eigenvectors
  - RSM Find All Eigenvalues and Some Eigenvectors
  
- **REAL SYMMETRIC BAND EIGENSYSTEMS**
  - RSB Find Eigenvalues and Eigenvectors
  
- **REAL SYMMETRIC TRIDIAGONAL EIGENSYSTEMS**
  - RST Find Eigenvalues and Eigenvectors
  
- **REAL SPECIAL TRIDIAGONAL EIGENSYSTEMS**
  - RT Find Eigenvalues and Eigenvectors

- **COMPLEX GENERALIZED EIGENSYSTEMS**
  - CGG Find Generalized Eigenvalues and Eigenvectors
- **HERMITIAN GENERALIZED EIGENSYSTEM**
  - CHG Find Generalized Eigenvalues and Eigenvectors
  - CHGAB Find Generalized Eigenvalues and Eigenvectors
  - CHGBA Find Generalized Eigenvalues and Eigenvectors
- **COMPLEX GENERAL EIGENSYSTEMS**
  - CG Find Eigenvalues and Eigenvectors, QZ Algorithm
  - CGLZ Find Eigenvalues and Eigenvectors, LZ Algorithm
- **HERMITIAN EIGENSYSTEMS**
  - CH Find Eigenvalues and Eigenvectors
- **REAL GENERALIZED EIGENSYSTEMS**
- **QZ Algorithm**
  - QZHES Reduction to Hessenberg Find
  - QZIT QZ Algorithm Iteration Step
  - QZVAL Find Generalized Eigenvalues
  - QZVEC Find Generalized Eigenvectors
- **REAL SYMMETRIC GENERALIZED EIGENSYSTEMS**
- **Reduction to Standard Symmetric Eigenproblem**
  - REDUC Reduction Using Cholesky Factorization for AB
  - REDUC2 Reduction Using Cholesky Factorization for BA
- **Eigenvectors**
  - REBAK Find Eigenvectors for AB
  - REBAKB Find Eigenvectors for BA
- **REAL GENERAL EIGENSYSTEMS**
- **Balancing**
  - BALANC Matrix Balancing
- **Reduction to Hessenberg form**
  - ORTHES Reduction by Orthogonal Transformations
  - ORTRAN Reduction and Accumulation the Transformations
  - ELMHES Reduction by Elementary Transformations
  - ELTRAN Reduction and Accumulation the Transformations
- **Eigenvalues and Eigenvectors**
  - HQR Find Eigenvalues, QR Algorithm
  - HQR2 Find Eigenvalues and Eigenvectors, QR Algorithm
  - INVIT Find Eigenvectors Corresponding to Specified Eigenvalues, Inverse Iteration
  - ORTBAK Find Eigenvectors, Orthogonal Transformations
  - ELMBAK Find Eigenvectors, Elementary Transformations
  - BALBAK Find Eigenvectors of Balanced Matrix

- **REAL SYMMETRIC EIGENSYSTEMS**
- **Reduction to Symmetric Tridiagonal Find**
  - TRED1 Reduction by Orthogonal Transformations
  - TRED2 Reduction and Accumulation the Transformations
- **Eigenvectors**
  - TRBAK1 Find Eigenvectors
- **REAL SYMMETRIC BAND EIGENSYSTEMS**
- **Reduction to Symmetric Tridiagonal Find**
  - BANDR Reduction and Accumulation Orthogonal Transformations
- **Eigenvalues**
  - BQR Find Eigenvalue of Smallest Magnitude, QR Algorithm
- **Eigenvectors**
  - BANDV Find Eigenvectors Corresponding to Specified Eigenvalues
- **REAL TRIDIAGONAL EIGENSYSTEMS**
- **Reduction to Symmetric Tridiagonal Find**
  - FIGI Reduction by Diagonal Transformations
  - FIGI2 Reduction and Accumulation the Transformations
- **Eigenvectors**
  - BAKVEC Find Eigenvectors
- **REAL SYMMETRIC TRIDIAGONAL EIGENSYSTEMS**
- **Eigenvalues and Eigenvectors**
  - TQL1 Find Eigenvalues, QL Algorithm
  - IMTQL1 Find Eigenvalues, Implicit QL Algorithm
  - IMTQLV Find Eigenvalues, Implicit QL Algorithm
  - TQLRAT Find Eigenvalues, Rational QL Algorithm
  - TQL2 Find Eigenvalues and Eigenvectors, QL Algorithm
  - IMTQL2 Find Eigenvalues and Eigenvectors, Implicit QL Algorithm
  - RATQR Find Smallest or Largest Eigenvalue, Rational QR Algorithm
  - BISECT Find Eigenvalues Within Specified Interval
  - TRIDIB Find Eigenvalues Between Specified Boundary Indices
  - TSTURM Find Eigenvalues Within Specified Interval and Corresponding Eigenvectors
  - TINVIT Find Eigenvectors Corresponding to Specified Eigenvalues
- **COMPLEX GENERALIZED EIGENSYSTEMS**
- **LZ Algorithm**
  - CLZHES Reduction to Hessenberg Find
  - CLZIT LZ Algorithm Iteration Step
  - CLZVEC Find Generalized Eigenvectors
- **QZ Algorithm**
  - CQZHES Reduction to Hessenberg Find
  - CQZIT QZ Algorithm Iteration Step
  - CQZVEC Find Generalized Eigenvectors

- **HERMITIAN GENERALIZED EIGENSYSTEMS**
- **Reduction to Hermitian Eigenproblem**
  - HRDUC Reduction Using Cholesky Factorization for AB
  - HRDUC2 Reduction Using Cholesky Factorization for BA
- **Eigenvectors**
  - HRBAK Find Eigenvectors for AB
  - HRBAKB Find Eigenvectors for BA
- **COMPLEX GENERAL EIGENSYSTEMS**
- **Balancing**
  - CBAL Matrix Balancing
- **Reduction to Hessenberg form**
  - CORTH Reduction by Unitary Transformations
  - COMHES Reduction by Elementary Transformations
- **Eigenvalues and Eigenvectors**
  - COMLR Find Eigenvalues, LR Algorithm
  - COMLR2 Find Eigenvalues and Eigenvectors, LR Algorithm
  - COMQR Find Eigenvalues, QR Algorithm
  - COMQR2 Find Eigenvalues and Eigenvectors, QR Algorithm
  - COMBAK Find Eigenvectors
  - CORTB Find Eigenvectors
  - CINVIT Find Eigenvectors Corresponding to Specified Eigenvalues, Inverse Iteration
  - CBABK2 Find Eigenvectors of Balanced Matrix
- **HERMITIAN EIGENSYSTEMS**
- **Reduction to Real Symmetric Tridiagonal Form**
  - HTRID3 Reduction by Unitary Transformations
  - HTRIDI Reduction by Unitary Transformations
- **Eigenvectors**
  - HTRIB3 Find Eigenvectors
  - HTRIBK Find Eigenvectors
- **SINGULAR VALUE DECOMPOSITION**
  - SSVDC Decomposition of a Real Matrix
  - MINFIT Minimum Norm Least Squares Solutions
  - CSVDC Decomposition of a Complex Matrix
- **QUASI-TRIANGULAR DECOMPOSITION**
  - HQRDC Orthogonal Quasi-Triangular Decomposition

- **MEMORY STORAGE ALLOCATION**
- **Real Matrices, Vectors**
  - Allocate storage for a real vector (macro)
  - Allocate storage for a real general matrix
  - Allocate storage for a real general band matrix
  - Allocate storage for a real symmetric/triangular matrix
  - Allocate storage for a real symmetric/triangular band matrix
- **Complex Matrices, Vectors**
  - Allocate storage for a complex vector (macro)
  - Allocate storage for a complex general matrix
  - Allocate storage for a complex general band matrix
  - Allocate storage for a complex symmetric/hermitian/triangular matrix
  - Allocate storage for a complex symmetric/hermitian/triangular band matrix