NAME

cunbdb1.f –

SYNOPSIS

Functions/Subroutines

subroutine **cunbdb1** (M, P, Q, X11, LDX11, X21, LDX21, THETA, PHI, TAUP1, TAUP2, TAUQ1, WORK, LWORK, INFO)

CUNBDB1

Function/Subroutine Documentation

subroutine cunbdb1 (integerM, integerP, integerQ, complex, dimension(ldx11,*)X11, integerLDX11, complex, dimension(ldx21,*)X21, integerLDX21, real, dimension(*)THETA, real, dimension(*)PHI, complex, dimension(*)TAUP1, complex, dimension(*)TAUP2, complex, dimension(*)TAUQ1, complex, dimension(*)WORK, integerLWORK, integerINFO)

CUNBDB1

Purpose:

CUNBDB1 simultaneously bidiagonalizes the blocks of a tall and skinny
matrix X with orthonomal columns:

```
                      [ B11 ]
     [ X11 ]  [ P1 |    ] [  0  ]
     [-----] = [---------] [-----] Q1**T .
     [ X21 ]  [    | P2 ] [ B21 ]
                      [  0  ]
```

X11 is P-by-Q, and X21 is (M-P)-by-Q. Q must be no larger than P,
M-P, or M-Q. Routines CUNBDB2, CUNBDB3, and CUNBDB4 handle cases in
which Q is not the minimum dimension.

The unitary matrices P1, P2, and Q1 are P-by-P, (M-P)-by-(M-P),
and (M-Q)-by-(M-Q), respectively. They are represented implicitly by
Householder vectors.

B11 and B12 are Q-by-Q bidiagonal matrices represented implicitly by
angles THETA, PHI..fi

Parameters:

M

M is INTEGER
The number of rows X11 plus the number of rows in X21.

P

P is INTEGER
The number of rows in X11. $0 <= P <= M$.

Q

Q is INTEGER
The number of columns in X11 and X21. $0 <= Q <= MIN(P,M-P,M-Q)$.

X11

X11 is COMPLEX array, dimension (LDX11,Q)
On entry, the top block of the matrix X to be reduced. On
exit, the columns of tril(X11) specify reflectors for P1 and
the rows of triu(X11,1) specify reflectors for Q1.

LDX11

LDX11 is INTEGER
The leading dimension of X11. $LDX11 >= P$.

X21

       X21 is COMPLEX array, dimension (LDX21,Q)
      On entry, the bottom block of the matrix X to be reduced. On
      exit, the columns of tril(X21) specify reflectors for P2.

LDX21

      LDX21 is INTEGER
      The leading dimension of X21. LDX21 >= M-P.

THETA

      THETA is REAL array, dimension (Q)
      The entries of the bidiagonal blocks B11, B21 are defined by
      THETA and PHI. See Further Details.

PHI

      PHI is REAL array, dimension (Q-1)
      The entries of the bidiagonal blocks B11, B21 are defined by
      THETA and PHI. See Further Details.

TAUP1

      TAUP1 is COMPLEX array, dimension (P)
      The scalar factors of the elementary reflectors that define
      P1.

TAUP2

      TAUP2 is COMPLEX array, dimension (M-P)
      The scalar factors of the elementary reflectors that define
      P2.

TAUQ1

      TAUQ1 is COMPLEX array, dimension (Q)
      The scalar factors of the elementary reflectors that define
      Q1.

WORK

      WORK is COMPLEX array, dimension (LWORK)

LWORK

      LWORK is INTEGER
      The dimension of the array WORK. LWORK >= M-Q.

      If LWORK = -1, then a workspace query is assumed; the routine
      only calculates the optimal size of the WORK array, returns
      this value as the first entry of the WORK array, and no error
      message related to LWORK is issued by XERBLA.

INFO

      INFO is INTEGER
      = 0: successful exit.
      < 0: if INFO = -i, the i-th argument had an illegal value.

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Further Details:

The upper-bidiagonal blocks B11, B21 are represented implicitly by angles THETA(1), ..., THETA(Q) and PHI(1), ..., PHI(Q-1). Every entry in each bidiagonal band is a product of a sine or cosine of a THETA with a sine or cosine of a PHI. See [1] or CUNCSD for details.

P1, P2, and Q1 are represented as products of elementary reflectors. See CUNCSD2BY1 for details on generating P1, P2, and Q1 using CUNGQR and CUNGLQ.

References:
[1] Brian D. Sutton. Computing the complete CS decomposition. Numer. Algorithms, 50(1):33-65, 2009.

Definition at line 202 of file cunbdb1.f.

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