NAME

cunbdb3.f −

SYNOPSIS

Functions/Subroutines

subroutine **cunbdb3** (M, P, Q, X11, LDX11, X21, LDX21, THETA, PHI, TAUP1, TAUP2, TAUQ1, WORK, LWORK, INFO)
CUNBDB3

Function/Subroutine Documentation

subroutine cunbdb3 (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)
CUNBDB3

Purpose:

CUNBDB3 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. M-P must be no larger than P, Q, or M-Q. Routines CUNBDB1, CUNBDB2, and CUNBDB4 handle cases in which M-P 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 (M-P)-by-(M-P) 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. M-P <= min(P,Q,M-Q).

Q

Q is INTEGER
The number of columns in X11 and X21. 0 <= Q <= M.

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 cunbdb3.f.

Author

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