Quick Reference Guide to the BLAS

Level 1 BLAS

```
                   dim scalar vector   vector   scalars             5-element prefixes
                                                                    array

SUBROUTINE _ROTG (                                      A, B, C, S )          S, D
SUBROUTINE _ROTMG(                                D1, D2, A, B,         PARAM ) S, D
SUBROUTINE _ROT  ( N,          X, INCX, Y, INCY,                C, S )          S, D
SUBROUTINE _ROTM ( N,          X, INCX, Y, INCY,                       PARAM ) S, D
SUBROUTINE _SWAP ( N,          X, INCX, Y, INCY )                              S, D, C, Z
SUBROUTINE _SCAL ( N,  ALPHA, X, INCX )                                        S, D, C, Z, CS, ZD
SUBROUTINE _COPY ( N,          X, INCX, Y, INCY )                              S, D, C, Z
SUBROUTINE _AXPY ( N,  ALPHA, X, INCX, Y, INCY )                               S, D, C, Z
FUNCTION   _DOT  ( N,          X, INCX, Y, INCY )                              S, D, DS
FUNCTION   _DOTU ( N,          X, INCX, Y, INCY )                              C, Z
FUNCTION   _DOTC ( N,          X, INCX, Y, INCY )                              C, Z
FUNCTION   __DOT ( N,  ALPHA, X, INCX, Y, INCY )                               SDS
FUNCTION   _NRM2 ( N,          X, INCX )                                       S, D, SC, DZ
FUNCTION   _ASUM ( N,          X, INCX )                                       S, D, SC, DZ
FUNCTION   I_AMAX( N,          X, INCX )                                       S, D, C, Z
```

Name	Operation	Prefixes
_ROTG	Generate plane rotation	S, D
_ROTMG	Generate modified plane rotation	S, D
_ROT	Apply plane rotation	S, D
_ROTM	Apply modified plane rotation	S, D
_SWAP	$x \leftrightarrow y$	S, D, C, Z
_SCAL	$x \leftarrow \alpha x$	S, D, C, Z, CS, ZD
_COPY	$y \leftarrow x$	S, D, C, Z
_AXPY	$y \leftarrow \alpha x + y$	S, D, C, Z
_DOT	$dot \leftarrow x^T y$	S, D, DS
_DOTU	$dot \leftarrow x^T y$	C, Z
_DOTC	$dot \leftarrow x^H y$	C, Z
__DOT	$dot \leftarrow \alpha + x^T y$	SDS
_NRM2	$nrm2 \leftarrow \|\|x\|\|_2$	S, D, SC, DZ

_ASUM	$asum \leftarrow \|\|re(x)\|\|_1 + \|\|im(x)\|\|_1$	S, D, SC, DZ
I_AMAX	$amax \leftarrow 1^{st} k \ni \|re(x_k)\| + \|im(x_k)\|$	S, D, C, Z
	= *max*(| *re*(*x i*) | + | *im*(*x i*) |)	

Level 2 BLAS

```
        options            dim   b-width scalar matrix  vector   scalar vector   prefixes

_GEMV (        TRANS,      M, N,         ALPHA, A, LDA, X, INCX, BETA,  Y, INCY ) S, D, C, Z
_GBMV (        TRANS,      M, N, KL, KU, ALPHA, A, LDA, X, INCX, BETA,  Y, INCY ) S, D, C, Z
_HEMV ( UPLO,                 N,         ALPHA, A, LDA, X, INCX, BETA,  Y, INCY ) C, Z
_HBMV ( UPLO,                 N, K,      ALPHA, A, LDA, X, INCX, BETA,  Y, INCY ) C, Z
_HPMV ( UPLO,                 N,         ALPHA, AP,     X, INCX, BETA,  Y, INCY ) C, Z
_SYMV ( UPLO,                 N,         ALPHA, A, LDA, X, INCX, BETA,  Y, INCY ) S, D
_SBMV ( UPLO,                 N, K,      ALPHA, A, LDA, X, INCX, BETA,  Y, INCY ) S, D
_SPMV ( UPLO,                 N,         ALPHA, AP,     X, INCX, BETA,  Y, INCY ) S, D
_TRMV ( UPLO, TRANS, DIAG,    N,                A, LDA, X, INCX )                 S, D, C, Z
_TBMV ( UPLO, TRANS, DIAG,    N, K,             A, LDA, X, INCX )                 S, D, C, Z
_TPMV ( UPLO, TRANS, DIAG,    N,                AP,     X, INCX )                 S, D, C, Z
_TRSV ( UPLO, TRANS, DIAG,    N,                A, LDA, X, INCX )                 S, D, C, Z
_TBSV ( UPLO, TRANS, DIAG,    N, K,             A, LDA, X, INCX )                 S, D, C, Z
_TPSV ( UPLO, TRANS, DIAG,    N,                AP,     X, INCX )                 S, D, C, Z

        options            dim   scalar vector   vector   matrix  prefixes

_GER  (                    M, N, ALPHA, X, INCX, Y, INCY, A, LDA ) S, D
_GERU (                    M, N, ALPHA, X, INCX, Y, INCY, A, LDA ) C, Z
_GERC (                    M, N, ALPHA, X, INCX, Y, INCY, A, LDA ) C, Z
_HER  ( UPLO,                 N, ALPHA, X, INCX,           A, LDA ) C, Z
_HPR  ( UPLO,                 N, ALPHA, X, INCX,           AP )     C, Z
_HER2 ( UPLO,                 N, ALPHA, X, INCX, Y, INCY, A, LDA ) C, Z
_HPR2 ( UPLO,                 N, ALPHA, X, INCX, Y, INCY, AP )     C, Z
_SYR  ( UPLO,                 N, ALPHA, X, INCX,           A, LDA ) S, D
_SPR  ( UPLO,                 N, ALPHA, X, INCX,           AP )     S, D
_SYR2 ( UPLO,                 N, ALPHA, X, INCX, Y, INCY, A, LDA ) S, D
_SPR2 ( UPLO,                 N, ALPHA, X, INCX, Y, INCY, AP )     S, D
```

Level 3 BLAS

```
        options                          dim      scalar matrix  matrix  scalar matrix  prefixes

_GEMM (             TRANSA, TRANSB,      M, N, K, ALPHA, A, LDA, B, LDB, BETA,  C, LDC ) S, D, C, Z
_SYMM ( SIDE, UPLO,                      M, N,    ALPHA, A, LDA, B, LDB, BETA,  C, LDC ) S, D, C, Z
_HEMM ( SIDE, UPLO,                      M, N,    ALPHA, A, LDA, B, LDB, BETA,  C, LDC ) C, Z
_SYRK (       UPLO, TRANS,                  N, K, ALPHA, A, LDA,         BETA,  C, LDC ) S, D, C, Z
_HERK (       UPLO, TRANS,                  N, K, ALPHA, A, LDA,         BETA,  C, LDC ) C, Z
_SYR2K(       UPLO, TRANS,                  N, K, ALPHA, A, LDA, B, LDB, BETA,  C, LDC ) S, D, C, Z
_HER2K(       UPLO, TRANS,                  N, K, ALPHA, A, LDA, B, LDB, BETA,  C, LDC ) C, Z
_TRMM ( SIDE, UPLO, TRANSA,        DIAG, M, N,    ALPHA, A, LDA, B, LDB )               S, D, C, Z
_TRSM ( SIDE, UPLO, TRANSA,        DIAG, M, N,    ALPHA, A, LDA, B, LDB )               S, D, C, Z
```

Name	Operation	Prefixes

_GEMV	$y \leftarrow \alpha Ax + \beta y, y \leftarrow \alpha A^T x + \beta y, y \leftarrow \alpha A^H x + \beta y, A - m \times n$	S, D, C, Z
_GBMV	$y \leftarrow \alpha Ax + \beta y, y \leftarrow \alpha A^T x + \beta y, y \leftarrow \alpha A^H x + \beta y, A - m \times n$	S, D, C, Z
_HEMV	$y \leftarrow \alpha Ax + \beta y$	C, Z
_HBMV	$y \leftarrow \alpha Ax + \beta y$	C, Z
_HPMV	$y \leftarrow \alpha Ax + \beta y$	C, Z
_SYMV	$y \leftarrow \alpha Ax + \beta y$	S, D
_SBMV	$y \leftarrow \alpha Ax + \beta y$	S, D
_SPMV	$y \leftarrow \alpha Ax + \beta y$	S, D
_TRMV	$x \leftarrow Ax, x \leftarrow A^T x, x \leftarrow A^H x$	S, D, C, Z
_TBMV	$x \leftarrow Ax, x \leftarrow A^T x, x \leftarrow A^H x$	S, D, C, Z
_TPMV	$x \leftarrow Ax, x \leftarrow A^T x, x \leftarrow A^H x$	S, D, C, Z
_TRSV	$x \leftarrow A^{-1} x, x \leftarrow A^{-T} x, x \leftarrow A^{-H} x$	S, D, C, Z
_TBSV	$x \leftarrow A^{-1} x, x \leftarrow A^{-T} x, x \leftarrow A^{-H} x$	S, D, C, Z
_TPSV	$x \leftarrow A^{-1} x, x \leftarrow A^{-T} x, x \leftarrow A^{-H} x$	S, D, C, Z
_GER	$A \leftarrow \alpha x y^T + A, A - m \times n$	S, D
_GERU	$A \leftarrow \alpha x y^T + A, A - m \times n$	C, Z
_GERC	$A \leftarrow \alpha x y^H + A, A - m \times n$	C, Z
_HER	$A \leftarrow \alpha x x^H + A$	C, Z
_HPR	$A \leftarrow \alpha x x^H + A$	C, Z
_HER2	$A \leftarrow \alpha x y^H + y(\alpha x)^H + A$	C, Z
_HPR2	$A \leftarrow \alpha x y^H + y(\alpha x)^H + A$	C, Z
_SYR	$A \leftarrow \alpha x x^T + A$	S, D
_SPR	$A \leftarrow \alpha x x^T + A$	S, D
_SYR2	$A \leftarrow \alpha x y^T + \alpha y x^T + A$	S, D
_SPR2	$A \leftarrow \alpha x y^T + \alpha y x^T + A$	S, D

Name	Operation	Prefixes
_GEMM	$C \leftarrow \alpha op(A) op(B) + \beta C, op(X) = X, X^T, X^H, C - m \times n$	S, D, C, Z
_SYMM	$C \leftarrow \alpha AB + \beta C, C \leftarrow \alpha BA + \beta C, C - m \times n, A = A^T$	S, D, C, Z
_HEMM	$C \leftarrow \alpha AB + \beta C, C \leftarrow \alpha BA + \beta C, C - m \times n, A = A^H$	C, Z
_SYRK	$C \leftarrow \alpha AA^T + \beta C, C \leftarrow \alpha A^T A + \beta C, C - n \times n$	S, D, C, Z
_HERK	$C \leftarrow \alpha AA^H + \beta C, C \leftarrow \alpha A^H A + \beta C, C - n \times n$	C, Z
_SYR2K	$C \leftarrow \alpha AB^T + \alpha BA^T + \beta C, C \leftarrow \alpha A^T B + \alpha B^T A + \beta C, C - n \times n$	S, D, C, Z
_HER2K	$C \leftarrow \alpha AB^H + \bar{\alpha} BA^H + \beta C, C \leftarrow \alpha A^H B + \bar{\alpha} B^H A + \beta C, C - n \times n$	C, Z
_TRMM	$B \leftarrow \alpha op(A) B, B \leftarrow \alpha B op(A), op(A) = A, A^T, A^H, B - m \times n$	S, D, C, Z
_TRSM	$B \leftarrow \alpha op(A^{-1}) B, B \leftarrow \alpha B op(A^{-1}), op(A) = A, A^T, A^H, B - m \times n$	S, D, C, Z

Notes

Meaning of prefixes

S - REAL C - COMPLEX
D - DOUBLE PRECISION Z - COMPLEX*16 (this may not be supported by all machines)

For the Level 2 BLAS a set of extended-precision routines with the prefixes ES, ED, EC, EZ may also be available.

Level 1 BLAS

In addition to the listed routines there are two further extended-precision dot product routines DQDOTI and DQDOTA.

Level 2 and Level 3 BLAS

Matrix types

GE - GEneral	GB - General Band	
SY - SYmmetric	SB - Symmetric Band	SP - Symmetric Packed
HE - HErmitian	HB - Hermitian Band	HP - Hermitian Packed
TR - TRiangular	TB - Triangular Band	TP - Triangular Packed

Options

Arguments describing options are declared as CHARACTER*1 and may be passed as character strings.

TRANS	= ` **N**o transpose', ` **T**ranspose', ` **C**onjugate transpose' (X, X^T, X^C)
UPLO	= ` **U**pper triangular', ` **L**ower triangular'
DIAG	= ` **N**on-unit triangular', ` **U**nit triangular'
SIDE	= ` **L**eft', ` **R**ight' (A or op(A) on the left, or A or op(A) on the right)

For real matrices, TRANS = `T' and TRANS = `C' have the same meaning.
For Hermitian matrices, TRANS = `T' is not allowed.
For complex symmetric matrices, TRANS = `H' is not allowed.

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