BLAS C prototypes

```
#include <cblas.h>
```

All functions are prefaced by `cblas_`

Level 1 BLAS: vector, $O(n)$ operations

precisions	name	(size	arguments)	description	equation
s, d, c, z	axpy	(n,	alpha, x, incx, y, incy)	update vector	$y = y + \alpha x$
s, d, c, z, cs, zd	scal	(n,	alpha, x, incx)	scale vector	$y = \alpha y$
s, d, c, z	copy	(n,	x, incx, y, incy)	copy vector	$y = x$
s, d, c, z	swap	(n,	x, incx, y, incy)	swap vectors	$x \leftrightarrow y$
s, d	dot	(n,	x, incx, y, incy)	dot product	$= x^T y$
c, z	dotu_sub	(n,	x, incx, y, incy, &output)	(complex)	$= x^T y$
c, z	dotc_sub	(n,	x, incx, y, incy, &output)	(complex conj)	$= x^H y$
sds, ds	dot	(n,	x, incx, y, incy)	(internally double precision)	$= x^T y$
s, d, sc, dz	nrm2	(n,	x, incx)	2-norm	$= \|x\|_2$
s, d, sc, dz	asum	(n,	x, incx)	1-norm	$= \|\mathrm{Re}(x)\|_1 + \|\mathrm{Im}(x)\|_1$
s, d, c, z	i_amax	(n,	x, incx)	∞-norm	$= i$ such that $\lvert\mathrm{Re}(x_i)\rvert + \lvert\mathrm{Im}(x_i)\rvert$ is max
s, d, c, z	rotg	(	a, b, c, s)	generate plane (Given's) rotation (c real, s complex)	
s, d, c, z †	rot	(n,	x, incx, y, incy, c, s)	apply plane rotation (c real, s complex)	
cs, zd	rot	(n,	x, incx, y, incy, c, s)	apply plane rotation (c & s real)	
s, d	rotmg	(	d1, d2, a, b, param)	generate modified plane rotation	
s, d	rotm	(n,	x, incx, y, incy, param)	apply modified plane rotation	

Level 2 BLAS: matrix-vector, $O(n^2)$ operations

precisions	name	(order options	size	arguments)	description	equation
s, d, c, z	gemv	(order, trans,	m, n,	alpha, A, ldA, x, incx, beta, y, incy)	general matrix-vector multiply	$y = \alpha A^* x + \beta y$
c, z	hemv	(order, uplo,	n,	alpha, A, ldA, x, incx, beta, y, incy)	Hermitian matrix-vector mul.	$y = \alpha A x + \beta y$
s, d, c, z †	symv	(order, uplo,	n,	alpha, A, ldA, x, incx, beta, y, incy)	symmetric matrix-vector mul.	$y = \alpha A x + \beta y$
s, d, c, z	trmv	(order, uplo, trans, diag,	n,	A, ldA, x, incx)	triangular matrix-vector mul.	$x = A^* x$
s, d, c, z	trsv	(order, uplo, trans, diag,	n,	A, ldA, x, incx)	triangular solve	$x = A^{-*} x$
s, d	ger	(order,	m, n,	alpha, x, incx, y, incy, A, ldA)	general rank-1 update	$A = A + \alpha x y^T$
c, z	geru	(order,	m, n,	alpha, x, incx, y, incy, A, ldA)	general rank-1 update (complex)	$A = A + \alpha x y^T$
c, z	gerc	(order,	m, n,	alpha, x, incx, y, incy, A, ldA)	general rank-1 update (complex conj)	$A = A + \alpha x y^H$
c, z	her	(order, uplo,	n,	alpha, x, incx, A, ldA)	Hermitian rank-1 update	$A = A + \alpha x x^H$
c, z	her2	(order, uplo,	n,	alpha, x, incx, y, incy, A, ldA)	Hermitian rank-2 update	$A = A + \alpha x y^H + y(\alpha x)^H$
s, d, c, z †	syr	(order, uplo,	n,	alpha, x, incx, A, ldA)	symmetric rank-1 update	$A = A + \alpha x x^T$
s, d	syr2	(order, uplo,	n,	alpha, x, incx, y, incy, A, ldA)	symmetric rank-2 update	$A = A + \alpha x y^T + \alpha y x^T$

Level 2 BLAS, band storage

precisions	name	(order options	size	bandwidth	arguments)	description	equation
s, d, c, z	gbmv	(order, trans,	m, n,	kl, ku,	alpha, A, ldA, x, incx, beta, y, incy)	band general matrix-vector multiply	$y = \alpha A^* x + \beta y$
c, z	hbmv	(order, uplo,	n,	k,	alpha, A, ldA, x, incx, beta, y, incy)	band Hermitian matrix-vector mul.	$y = \alpha A x + \beta y$
s, d	sbmv	(order, uplo,	n,	k,	alpha, A, ldA, x, incx, beta, y, incy)	band symmetric matrix-vector mul.	$y = \alpha A x + \beta y$
s, d, c, z	tbmv	(order, uplo, trans, diag,	n,	k,	A, ldA, x, incx)	band triangular matrix-vector mul.	$x = A^* x$
s, d, c, z	tbsv	(order, uplo, trans, diag,	n,	k,	A, ldA, x, incx)	band triangular solve	$x = A^{-*} x$

Level 2 BLAS, packed storage

precisions	name	(order options	size	arguments)	description	equation
c, z	hpmv	(order, uplo,	n,	alpha, Ap, x, incx, beta, y, incy)	packed Hermitian matrix-vector mul.	$y = \alpha A x + \beta y$
s, d, c, z †	spmv	(order, uplo,	n,	alpha, Ap, x, incx, beta, y, incy)	packed symmetric matrix-vector mul.	$y = \alpha A x + \beta y$
s, d, c, z	tpmv	(order, uplo, trans, diag,	n,	Ap, x, incx)	packed triangular matrix-vector mul.	$x = A^* x$
s, d, c, z	tpsv	(order, uplo, trans, diag,	n,	Ap, x, incx)	packed triangular solve	$x = A^{-*} x$
c, z	hpr	(order, uplo,	n,	alpha, x, incx, Ap)	packed Hermitian rank-1 update	$A = A + \alpha x x^H$
c, z	hpr2	(order, uplo,	n,	alpha, x, incx, y, incy, Ap)	packed Hermitian rank-2 update	$A = A + \alpha x y^H + y(\alpha x)^H$
s, d, c, z †	spr	(order, uplo,	n,	alpha, x, incx, Ap)	packed symmetric rank-1 update	$A = A + \alpha x x^T$
s, d	spr2	(order, uplo,	n,	alpha, x, incx, y, incy, Ap)	packed symmetric rank-2 update	$A = A + \alpha x y^T + \alpha y x^T$

Level 3 BLAS: matrix-matrix, $O(n^3)$ operations

precisions	name	(order options	size	arguments)	description	equation
s, d, c, z	gemm	(order, transa, transb,	m, n, k,	alpha, A, ldA, B, ldB, beta, C, ldC)	general matrix-matrix multiply	$C = \alpha A^* B^* + \beta C$
s, d, c, z	symm	(order, side, uplo,	m, n,	alpha, A, ldA, B, ldB, beta, C, ldC)	symmetric matrix-matrix mul.	$C = \alpha AB + \beta C$
c, z	hemm	(order, side, uplo,	m, n,	alpha, A, ldA, B, ldB, beta, C, ldC)	Hermitian matrix-matrix mul.	$C = \alpha AB + \beta C$
s, d, c, z	trmm	(order, side, uplo, transa, diag,	m, n,	alpha, A, ldA, B, ldB)	triangular matrix-matrix mul.	$B = \alpha A^* B$ or $B = \alpha B A^*$
s, d, c, z	trsm	(order, side, uplo, transa, diag,	m, n,	alpha, A, ldA, B, ldB)	triangular solve matrix	$B = \alpha A^{-*} B$ or $B = \alpha B A^{-*}$
c, z	herk	(order, uplo, trans,	n, k,	alpha, A, ldA, beta, C, ldC)	Hermitian rank-k update	$C = \alpha A A^H + \beta C$
c, z	her2k	(order, uplo, trans,	n, k,	alpha, A, ldA, B, ldB, beta, C, ldC)	Hermitian rank-2k update	$C = \alpha A B^H + \bar{\alpha} B A^H + \beta C$
s, d, c, z	syrk	(order, uplo, trans,	n, k,	alpha, A, ldA, beta, C, ldC)	symmetric rank-k update	$C = \alpha A A^T + \beta C$
s, d, c, z	syr2k	(order, uplo, trans,	n, k,	alpha, A, ldA, B, ldB, beta, C, ldC)	symmetric rank-2k update	$C = \alpha A B^T + \bar{\alpha} B A^T + \beta C$

A^* denotes A, A^T, or A^H;
A^{-*} denotes A^{-1}, A^{-T}, or A^{-H}, depending on options and data type.
The destination matrix is $m \times n$ or $n \times n$. For matrix-matrix, the common dimension of A and B is k.

Prefixes

s – float	d – double	
c – float complex	z – double complex	
ge – general	gb – general banded	
sy – symmetric	sb – symmetric banded	sp – symmetric packed
he – Hermitian	hb – Hermitian banded	hp – Hermitian packed
tr – triangular	tb – triangular banded	tp – triangular packed

† LAPACK adds complex [cz]rot,
and complex-symmetric routines for symv, spmv, syr, spr,
but only with Fortran calling conventions, not in CBLAS.

Options

order = CblasRowMajor,	CblasColMajor	
trans = CblasNoTrans: A,	CblasTrans: A^T,	CblasConjTrans: A^H
uplo = CblasUpper,	CblasLower	
diag = CblasNonUnit,	CblasUnit	
side = CblasLeft: AB,	CblasRight: BA	

ldA is major stride—number of rows (if colwise) or cols (if rowwise) of parent matrix A. Useful for submatrices.
For real matrices, trans = CblasTrans and CblasConjTrans are the same.
For Hermitian matrices, trans = CblasTrans is not allowed.
For complex symmetric matrices, trans = CblasConjTrans is not allowed.