LAPACK Quick

Reference Guide

to the

Driver Routines

Release 3.0

Simple DriverS

Simple Driver Routines for Linear Equations

Symmetric/Hermitian Indefinite (Packed Storage)	Symmetric/Hermitian Indefinite	Symmetric/Hermitian Positive Definite Tridiagonal	Symmetric/Hermitian Positive Definite Band	Symmetric/Hermitian Positive Definite (Packed Storage)	Symmetric/Hermitian Positive Definite	General Tridiagonal	General Band	General	Matrix Type
SSPSV(UPLO, CSPSV(UPLO, CHPSV(UPLO,	SSYSV(UPLO, CSYSV(UPLO, CHESV(UPLO,	SPTSV(CPTSV(SPBSV(UPLO, N, KD, CPBSV(UPLO, N, KD,	SPPSV(UPLO, CPPSV(UPLO,	SPOSV(UPLO, CPOSV(UPLO,	SGTSV(SGBSV(CGBSV(SGESV(Routine
= = = = = = = = = = = = = = = = = = =		. .	N, KD,	. .	= =	= ; = ;	N, KL, KU,	N,	
NRHS, NRHS, NRHS,	NRHS, NRHS,	NRHS,	NRHS,	NRHS,	NRHS,	NRHS,	NRHS,	NRHS,	
AP,	, A, LDA, , A, LDA, , A, LDA,	D, E,	AB, LDAB, AB, LDAB,	AP,	A, LDA, A, LDA,	DL, D, DU, DL, D, DU,	AB, LDAB, IPIV, AB, LDAB, IPIV,	NRHS, A, LDA, NRHS, A, LDA,	
IPIV, IPIV, IPIV,	IPIV, IPIV, IPIV,					~~~	IPIV, IPIV,	IPIV, IPIV,	
îm îm îm	în în în	œ̂æ	œœ	œ̂æ	œœ	œ œ	în în	, α α	
TDB, TDB,	LDB, WORK, LDB, WORK, LDB, WORK,	LDB,	LDB,	LDB,	LDB,	LDB,	B, LDB, B, LDB,	B, LDB, B, LDB,	
	LWORK, INFO LWORK, INFO LWORK, INFO								
INFO > INFO > INFO >	INFO > INFO > INFO >	INFO >	INFO >	INFO >	INFO >	INFO >	INFO >	INFO >	

Simple Driver Routines for Standard and Generalized Linear Least Squares Problems

Problem Type	Routine														
Solve Using Orthogonal Factor, Assuming Full Rank	SGELS(TRANS, H, N, NRHS, A, LDA, B, LDB, CGELS(TRANS, H, N, NRHS, A, LDA, B, LDB,	, ,	, ,	NRHS,	Α,	LDA,	ê ê	TDB,				WORK,	WORK, LWORK, INFO	INFO >	
Solve LSE Problem Using GRQ	SGGLSE(Ę	H, N, P,		Α,	A, LDA, B, LDB, C, D, X,	ıπ	EDB,	ů.	Ď,	×	WORK,	LHORK,	, INFO)	
Solve GLM Problem Using GQR	CGGGLH(, ,	N, H, P, N, H, P,		A A	A, LDA, B, LDB, D, X, Y, A, LDA, B, LDB, D, X, Y,	m m	TDB,	Ď,	××	Ý, Ý,	WORK,	LWORK,	, INFO >	

Simple and Divide and Conquer Driver Routines for Standard Eigenvalue and Singular Value Problems

General Singular Values/Vectors Divide and Conquer	General Eigenvalues/vectors	General Schur Factorization	Divide and Conquer	Symmetric Tridiagonal	Symmetric/Hermitian Band Eigenvalues/vectors Divide and Conquer	Divide and Conquer	Symmetric/Hermitian (Packed Storage) Risenvalues/vectors	Matrix/Frobem Type Symmetric/Hermitian Eigenvalues/vectors Divide and Conquer	Matrix / Droblem Tumo
SGESVD (CGESDD (CGESDD (SGEEV(JOBVL,	SGEES(SSTEVD	SSTEV(SSBEV(CHBEVD SSBEVD CHBEVD	SSPEVD (SSPEV(CHPEV(SSYEV(CHEEV(SSYEVD(CHEEVD(D
(JOBU, (JOBU, (JOBZ, (JOBZ,	SGEEV(JOBVL,	SGEES(JOBVS, CGEES(JOBVS,	SSTEVD(JOBZ	JOBZ	JOBZ, JOBZ, (JOBZ, (JOBZ,	SSPEVD(JOBZ, UPLO, CHPEVD(JOBZ, UPLO,	JOBZ, JOBZ,	SSYEV(JOBZ, SHEEV(JOBZ, SSYEVD(JOBZ, JOBZ, JOBZ,	5
JOBVI	, JOBVR, , JOBVR,	, SORT,	•	•	, UPLO,	, UPLO,	, UPLO,	, UPLO, , UPLO, , UPLO,	
'n	ų, ų,	, SELECT,				• •	• •		
	, , ,	CT, N,	z,	Z,	`a`a`a`a	E E	, , ,	2222	
			-	-	8888				
A, LDA A, LDA A, LDA A, LDA	A, LDA A, LDA	A, LDA, A, LDA,	D, E,	D, E,	##, EE	AP,	AP,	A, LDA, A, LDA, A, LDA, A, LDA,	
	,,,	LDA, SDIH, LDA, SDIH,			LDAB, LDAB, LDAB, LDAB,			5,55	
လ်လ်လ်	HR,	WR,			°£ °£ °£	°c °c	°c °c	°E °E °E °E	
	WI, VL, VL,	A IM	12	z,	ឯឯឯឯ	'n'n	ជំជំ		
u, rbu, u, rbu, u, rbu,	VL, LDVL,	VS, LDVS VS, LDVS	Z, LDZ,	, LDZ,		, LDZ,	, LDZ,		
Q, VI, VI, VI,	L, vr,	ังเ้ง							
LDVT, LDVT, LDVT,	LDVR, LDVR,								
, WORK, , WORK, , WORK,	, WORK,	WORK,	WORK	WORK	WORK, WORK, WORK,	WORK,	WORK WORK	HORK, HORK, HORK,	
, LWORK, , LWORK, , LWORK, , LWORK,	, LWORK,	, LWORK,	WORK, LWORK	•	, LWORK,	WORK, LHORK, WORK, LHORK, RWORK, LRHORK	• •	, LHORK, , LHORK, , LHORK, , LHORK,	
K, RWORK K, RWORK K, RWORK	K, K, RWORK	K, K, RWORK	ζ.			K, RWO	RWORK,	LHORK, LHORK, RHORK, LHORK, LHORK, RHORK, LRHORK	
RK,	RK,	RK,			RWORK, RWORK, LRWORK	RK, LI	RK,	RK, LI	
					lwork,	WORK,		łwork,	
IMORK IMORK			IWORK		IMORK,	IWORK IWORK		I WORK I WORK	
			IWORK, LIWORK		, LIWORK,	IWORK, LIWORK, IWORK, LIWORK,		IMORK, LIHORK	
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		BWORK, I	_	_					
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Simple and Divide and Conquer Driver Routines for Generalized Eigenvalue and Singular Value Problems

General Singular Values/Vectors	General Eigenvalues/vectors	General Schur Factorization	Divide and Conquer	Symmetric-definite (Band Storage) Figuryalues/vectors	Divide and Conquer	Symmetric-definite (Packed Storage) Figenvalues/vectors	Matrix/Problem Type Symmetric-definite Eigenvalues/vectors Divide and Conquer
SGGSVD(SGGEV (SGGES (SSBGVD(CHBGVD(SSBGV(SSPGVD(CHPGVD(SSPGV(Routine SSYGV(CHEGV(SSYGVD(CHEGVD(
, naor	JOBVL,	JOBVSL,			ITYPE, ITYPE,	ITYPE, ITYPE,	ITYPE, ITYPE, ITYPE, ITYPE,
JOBV,	JOBVR, JOBVR,	JOBVSR, JOBVSR,	JOBZ, JOBZ,	JOBZ, JOBZ,	JOBZ, JOBZ,	JOBZ, JOBZ,	JOBZ, JOBZ, JOBZ, JOBZ,
JOBY, JOBQ, H, N, P, K, L, A, LDA, JOBY, JOBQ, H, N, P, K, L, A, LDA,	'n'n,	R, SORT, R, SORT,	JOBZ, UPLO, JOBZ, UPLO,	UPLO,	'ondh 'ondh	, Ondah Ondah	, 014h , 014h , 014h
1, N, F							
, , , , , ,	, ,	SELCTG, N, A, LDA, SELCTG, N, A, LDA,	Z ,	, E	, ,	, .	`
, A, E	N, A, LDA, N, A, LDA,	A, LD, A, LD,	KA,	KA,	, , 5 5	÷ ÷	4444
LDA, B, LDB, LDA, B, LDB,	, ,		KB, AB, KB, AB,	KB, AB, KB, AB,	F F	쁏쁏	LDA, B, LDB, LDA, B, LDB, LDA, B, LDB, LDA, B, LDB,
LDB,	LDB,	B, LDB, S B, LDB, S	LDAB,	LDAB,			LDB, LDB, LDB,
A.C.	Æ	SDIH, AI	BB, L	88, L	<u>;c ;c</u>	<u>;c</u> ;c	ic ic ic ic
ALPHA, ALPHA,	ALPHAR, A ALPHA,	ALPHAR, ALPHA,	LDBB, W,	LDBB, W,	• •	• •	
	ALPHAI,	ALPHAI	; ; ; ;				
BETA,	BETA, VL, BETA, VL,	-					
n, rbr n, rbr	VL, LDVL, VR, VL, LDVL, VR,		Z, LDZ, Z, LDZ,	z, LDz z, LDz	Z, LDZ Z, LDZ	Z, LDZ, Z, LDZ	
', V, L	LDVL, VR, LDVL, VR,	VSL, LDVSL,	ğğ	ខ្លុំ	ģģ	ģģ	
BETA, U, LDU, V, LDV, Q, BETA, U, LDU, V, LDV, Q,	, LDVR, LDVR,						
БД,		LDVSR, LDVSR,					
HORK,	WORK, LWORK, RWORK	WORK, LWORK, RWORK.	HORK, I	HORK,	HORK, I	HORK,	HORK, LHORK, RHORK, HORK, LHORK, RHORK, HORK, LHORK, HORK, LHORK, RHORK, LI
	HORK,	HORK,	HORK,		HORK,		MORK, MORK, MORK,
RWORK,	RWORK,	RWORK,	RWORK,	RWORK,	RWORK,	RWORK,	RHORK,
			LRWORK		LRWORK		LRWORK
IWORK IWORK		BWORK,	HORK, LHORK, INFO MORK, LHORK, RHORK, LRHORK, LHORK, LIMORK, INFO		IHORK, LHORK, INFO HORK, LHORK, RWORK, LRHORK, IHORK, LIHORK, INFO		MORK, LMORK, INFO MORK, LHORK, RHORK, INFO MORK, LHORK, RHORK, INFO MORK, LHORK, RHORK, LHORK, INFO MORK, LHORK, RHORK, INFO
, ζ, ζ,		Χ,	K, LIWC		K, LIWC		K, LIWO
IN	IN	IN)RK, IN	IN	ORK, INFO	IN	INFO) INFO) INFO) ORK, INFO) ORK, INFO)
INFO)	INFO)	INFO)	FO)	INFO)	FO >	INFO)	INFO) INFO) INFO) INFO)
							•

Expert Drivers

Expert Driver Routines for Linear Equations

Symmetric/Hermitian Indefinite (Packed Storage)	${\bf Symmetric/Hermitian}\\ {\bf Indefinite}$	Symmetric/Hermitian Positive Definite Tridiagonal	Symmetric/Hermitian Positive Definite Band	Symmetric/Hermitian Positive Definite (Packed Storage)	Symmetric/Hermitian Positive Definite	General Tridiagonal	General Band	Matrix Type General
SSPSVX(FACT, UPLO, N, CSPSVX(FACT, UPLO, N, CHPSVX(FACT, UPLO, N,	SSYSVX(FACT, UPLO, N, CSYSVX(FACT, UPLO, N, CHESVX(FACT, UPLO, N,	SPTSVX(FACT, N, CPTSVX(FACT, N,	SPBSVX(FACT, UPLO, N, KD, CPBSVX(FACT, UPLO, N, KD,	SPPSVX(FACT, UPLO, N, CPPSVX(FACT, UPLO, N,	SPOSVX(FACT, UPLO, N, CPOSVX(FACT, UPLO, N,	SGTSVX(FACT, TRANS, N, CGTSVX(FACT, TRANS, N,	SGBSVX(FACT, TRANS, N, CGBSVX(FACT, TRANS, N,	Routine SGESVX(FACT, TRANS, N, CGESVX(FACT, TRANS, N,
NRHS, AP, NRHS, AP, NRHS, AP,	NRHS, A, LDA, NRHS, A, LDA, NRHS, A, LDA,	NRHS, D, E, NRHS, D, E,	KD, NRHS, AB, LDAB, KD, NRHS, AB, LDAB,	NRHS, AP, NRHS, AP,	NRHS, A, LDA, NRHS, A, LDA,	NRHS, DL, D, DU NRHS, DL, D, DU	TRANS, N, KL, KU, NRHS, AB, LDAB,	NRHS, A, LDA, NRHS, A, LDA,
AFP, IPIV, AFP, IPIV, AFP, IPIV,	AF, LDAF, IPIV, AF, LDAF, IPIV, AF, LDAF, IPIV,	DF, EF, DF, EF,	AFB, LDAFB, E	AFP, E	AF, LDAF, E AF, LDAF, E	NRHS, DL, D, DU, DLF, DF, DUF, DU2, NRHS, DL, D, DU, DLF, DF, DUF, DU2,	AFB, LDAFB, IPIV, AFB, LDAFB, IPIV,	AF, LDAF, IPIV, E AF, LDAF, IPIV, E
			EQUED, S, EQUED, S,	EQUED, S,	EQUED, S,	IPIV, IPIV,	EQUED, R, C, B, LDB, X, LDX, EQUED, R, C, B, LDB, X, LDX,	IPIV, EQUED, R, C, B, LDB, X, LDX, RCOND
, B, B, B	B B B	, , , ,	, В,	в, В,	, B	в,	, ,,	B B
TDB, X	CDB, X	LDB, X	LDB, X	CDB, X	CDB, X	LDB, X	LDB, X	LDB, X
X, LDX, X, LDX, X, LDX,	LDB, X, LDX, LDB, X, LDX, LDB, X, LDX,	B, LDB, X, LDX, B, LDB, X, LDX,	LDB, X, LDX, LDB, X, LDX,	LDB, X, LDX,	B, LDB, X, LDX, B, LDB, X, LDX,	X, LDX, X, LDX,	, LDX,	, LDX,
RCOND RCOND RCOND	RCOND RCOND RCOND	RCOND	RCOND	RCOND	RCOND	RCOND	RCOND	RCOND
, FERR, , FERR, , FERR,	, FERR, , FERR, , FERR,	, FERR,	, FERR,	, FERR,	, FERR,	, FERR,	, FERR,	
, BERR, , BERR, , BERR,	, BERR, , BERR, , BERR,	, BERR,	, BERR,	, BERR,	, BERR,	, BERR, , BERR,	, BERR,	, BERR , BERR
WORK,	, WORK, LWORK, GORK, LWORK, LWORK, LWORK, LWORK, LWORK, LWORK, LWORK, LWORK, LWORK,	, WORK,	, HORK,	, HORK,	, HORK,	, WORK,	, WORK,	FERR, BERR, WORK, FERR, BERR, WORK,
IMORK, RHORK, RHORK,	K, IWORK, K, RWORK, K, RWORK,	RWORK,	IWORK,	IWORK,	IWORK,	IWORK,	IWORK,	IMOR RMOR
uk, INFO uk, INFO uk, INFO	uk, INFO uk, INFO uk, INFO	INFO	ak, INFO ak, INFO	ak, INFO	ak, info ak, info	ak, INFO	ak, INFO	IWORK, INFO) RWORK, INFO)
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### Divide and Conquer and Expert Driver Routines for Linear Least Squares Problems

Solve Using D&C SVD, Allowing for Rank-Deficiency	Solve Using SVD, Allowing for Rank-Deficiency	Problem Type Solve Using Orthogonal Factor
SGELSD( H, N, NRHS, A, LDA, B, LDB, S, RCOHD, RANK, MORK, LAORK, RMORK, INORK, CGELSD( H, N, NRHS, A, LDA, B, LDB, S, RCOHD, RANK, MORK, LAORK, RMORK, INORK,	SGELSS( H, N, NRHS, A, LDA, B, LDB, S, RCOND, RANK, MORK, LMORK, CGELSS( H, N, NRHS, A, LDA, B, LDB, S, RCOND, RANK, MORK, LMORK, RMORK,	Routine SCELSY( H, N, NRHS, A, LDA, B, LDB, JPVT, RCOND, RANK, MORK, LHORK, CGELSY( H, N, NRHS, A, LDA, B, LDB, JPVT, RCOND, RANK, MORK, LHORK, RMORK,
ORK, INFO ) ORK, INFO )	INFO )	INFO ) INFO )

## Expert and RRR Driver Routines for Standard and Generalized Symmetric Eigenvalue Problems

тівенувнему устоль	Symmetric Tridiagonal		Symmetric/Hermitian Band Eigenvalues/vectors	TIPO CITAMINATORY CONTRACTOR	Symmetric/Hermitian (Packed Storage) Rigenvalues/vectors			Matrix/Problem Type Symmetric/Hermitian Eigenvalues/vectors
SSTEVR	SSTEVX(	SSBGVX(	SSBEVX (	SSPGVX	SSPEVX (	SSYGVX(	SSYEVR( CHEEVR(	Routine SSYEVX( CHEEVX(
SSTEVR( JOBZ,	( JOBZ	( JOBZ,		SSPGVX( ITYPE, CHPGVX( ITYPE,	( JOBZ	SSYGVX( ITYPE, CHEGVX( ITYPE,	( JOBZ,	ne ( 1082 ( 1082
, RANGE,	, RANGE	, RANGE,	JOBZ, RANGE, JOBZ, RANGE,	E, JOBZ, E, JOBZ,	JOBZ, RANGE, JOBZ, RANGE,	E, JOBZ, E, JOBZ,	SSYEVR( JOBZ, RANGE, CHEEVR( JOBZ, RANGE,	Routine SSYEVX( JOBZ, RANGE, UPLO, N, CHEEVX( JOBZ, RANGE, UPLO, N,
Î.u	Îm			Z, RANGE, Z, RANGE,		z, RANGE, z, RANGE,		E, UPLO
N,	'n.	), N, K	), N, K	##, FP1	UPLO, N, UPLO, N,	HE, UPLO,	UPLO, N,	), N,
D,	D,	(A, KB,	O, AB,	UPLO, N,	AP,	UPLO, N,	A,	A,
ĺπ	'n	AB, L	LDAB, LDAB,	AP,		<b>A</b> A	A, LDA, A, LDA,	A, LDA, A, LDA,
		DAB, B	6 6 6	, , 将 무 , ,		LDA,		
VL,	VL,	UPLO, N, KA, KB, AB, LDAB, BB, LDBB, Q, LDQ, VL, VU, IL, IU, ABSTOL, H, W, Z, LDZ, UPLO, N, KA, KB, AB, LDAB, BB, LDBB, Q, LDQ, VL, VU, IL, IU, ABSTOL, H, W, Z, LDZ,	UPLO, N, KD, AB, LDAB, Q, LDQ, VL, VU, IL, IU, ABSTOL, H, W, Z, LDZ, UPLO, N, KD, AB, LDAB, Q, LDQ, VL, VU, IL, IU, ABSTOL, H, W, Z, LDZ,		ar,	A, LDA, B, LDB, A, LDA, B, LDB,	Ar,	VL,
WU, II.	wu, II	9,0	a, a,	AT AT	W, IL, IV, W, IL, IV,		WU, IL, IU,	w, n
: U,	; U,	.bq, vr	;;	i în	î î	i în	II, IU,	 
ABSTOL	ABSTOL	, , a,	ABSTOL ABSTOL	VL, WU, IL, IU,	ABSTOL ABSTOL	AT' AN' IT' IN'	ABSTOL ABSTOL	VL, VU, IL, IU, ABSTOL, H, W, Z, VL, VU, IL, IU, ABSTOL, H, W, Z,
, H, K	, н, н	IT, IU	, E, E,	ABSTOI ABSTOI	, E, E,		, E, E,	, H, K
IU, ABSTOL, H, W, Z, LDZ,	IL, IU, ABSTOL, N, W, Z, LDZ	, ABSTO	, z, [	, , , , , , , , , , , , , , , , , , ,	ABSTOL, H, W, Z, LDZ, ABSTOL, H, W, Z, LDZ,		ABSTOL, H, W, Z, LDZ, ABSTOL, H, W, Z, LDZ,	, z, LDZ,
Σ,	Σ,	P, F,	ÿ,ÿ	ABSTOL, H, W, Z, LDZ, ABSTOL, H, W, Z, LDZ,	ÿ,ÿ	ABSTOL, H, W, Z, LDZ ABSTOL, H, W, Z, LDZ	ž, ž	LDZ, LDZ,
ISU		W, Z,		DZ,		LDZ,	ISU	
ISUPPZ, WORK,	50	LDZ, W	S. S.	SC SC	s: s:	5C 5C	ISUPPZ, W	S. S.
ORK, L	WORK,	WORK,	HORK,	WORK,	WORK,	ORK, L	ORK, L	WORK, L
LWORK,						WORK, LWORK, RWORK	WORK,	WORK, LWORK, RWORK
		RMORK,	RWORK,	RMORK,	RWORK,	RWORK,	RWORK,	RWORK,
							LRWORK	
IWORK	IHORK	IWORK,	IWORK,	IWORK, IWORK,	IWORK,	IWORK, IWORK,	WORK, LHORK, RHORK, LRHORK, INFO HORK, LHORK, INFO	IWORK
IWORK, LIWORK, INFO	IWORK, IFAIL, INFO	, IFAIL,	, IFAIL,		, IFAIL,	, IFAI , IFAI	, LINO	IWORK, IFAIL, INFO
RK, INI	L, INFO	L, INFO L, INFO	L, INFO L, INFO	IFAIL, INFO	L, INFO ) L, INFO )	, IFAIL, INFO )	RK, INI	L, INFO
~ O÷	) >	~ ~	) ) )	<u> </u>	~ ~	) )	70 ``	÷ ;

## Expert Driver Routines for Standard and Generalized Nonsymmetric Eigenvalue Problems

IWORK,	HORK, LHORK, HORK, I LHORK, BOORK, BOORK, LHORK, I LHORK, BOORK I LHORK	SGEEVX( BALANC, JOBVL, JOBVR, SENSE, N, A, LDA, KR, MI, VL, LDVL, VR, LDVR, ILO, IHI, SCALE, ABNRH, RCONDE, RCONDV, WORK, LKORK, LKORK, RMORK, LKORK,
IMORK,	HORK, LMORK, IMORK, LIMORK, BHORK, IMFO	SGGESK (JOBYSL, JOBYSR, SORT, SELCTG, SENSE, M, A, LDA, B, LDB, SDIH, ALPHAR, ALPHAI, BETA, VSL, LDVSL, VSR, LDVSR, RCONDE, RCONDV, GGGESK (JOBYSL, JOBYSR, SORT, SELCTG, SENSE, M, A, LDA, B, LDB, SDIH, ALPHAR, ALPHAI, BETA, VSL, LDVSL, VSR, LDVSR, RCONDE, RCONDV,
IWORK, LIWORK, BWORK, INFO	HORK, LHORK, RHORK,	SGEESX ( JOBYS , SORT , SELECT , SENSE, N, A , LDA , SDIH , WR , WI , VS , LDVS , RCOHDF , RC

### Meaning of prefixes

Routines beginning with "S" are available in:

S - REAL
D - DOUBLE PRECISION
Routines beginning with "C" are available in:

 $\label{eq:complex} C \mbox{--} COMPLEX*\\ Z \mbox{--} COMPLEX*16\\ Note: COMPLEX*16 may not be supported by all machines$