
**stichting
mathematisch
centrum**



DEPARTMENT OF NUMERICAL MATHEMATICS

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P.W. HEMKER (ed.)

NUMAL, A LIBRARY OF NUMERICAL PROCEDURES IN ALGOL 60
INDEX AND KWIC INDEX

3rd edition

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THE LIBRARY
NUMAL
OF ALGOL 60 PROCEDURES IN NUMERICAL MATHEMATICS

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INTRODUCTION.

AT THE REQUEST OF THE ACADEMIC COMPUTING CENTRE OF AMSTERDAM (SARA) THE MATHEMATICAL CENTRE HAS ADAPTED AND EXTENDED ITS LIBRARY OF NUMERICAL PROCEDURES FOR USE WITH THE CD CYBER 70 SYSTEM. THE RESULTING LIBRARY IS CALLED "NUMAL" ("NUM"ERICAL PROCEDURES IN "AL"GOL 60).

THE AIM OF NUMAL IS TO PROVIDE A HIGH LEVEL NUMERICAL LIBRARY FOR ALGOL 60 PROGRAMMERS. THE LIBRARY CONTAINS A SET OF VALIDATED NUMERICAL PROCEDURES TOGETHER WITH SUPPORTING DOCUMENTATION. EXCEPT FOR A SMALL NUMBER OF DOUBLE PRECISION ARITHMETIC ROUTINES ALL THE SOURCE TEXTS ARE WRITTEN IN ALGOL 60 AND THEY ARE TO A HIGH DEGREE INDEPENDENT OF THE COMPUTER/COMPILER USED.

THE LIBRARY IS UNDER CONTINUOUS DEVELOPMENT AND ,HENCE, ANY DESCRIPTION WILL BE AN INSTANTANEOUS ONE. THE MATHEMATICAL CENTRE WILL DISTRIBUTE UPDATINGS AND EXTENSIONS OF THE MANUAL ONCE A YEAR.

ORGANIZATION.

EACH PROCEDURE OF THE LIBRARY IS IDENTIFIED BY A NAME AND A CODE NUMBER. THE CODE NUMBER HAS TO BE USED WHEN, IN AN ALGOL 60 PROGRAM, REFERENCE IS MADE TO THE PRE-COMPILED PROCEDURE IN THE OBJECT CODE LIBRARY.

ALL PROCEDURES IN NUMAL ARE CLASSIFIED ACCORDING TO SUBJECT. THE SUBJECTS ARE IDENTIFIED BY A SECTION NUMBER. THE MANUAL IS ORDERED BY THESE SECTION NUMBERS.

IN ORDER TO FIND A PARTICULAR PROCEDURE, THERE IS A SYSTEMATICAL INDEX IN WHICH ALL PROCEDURES (THEIR NAMES AND THEIR CODE NUMBERS) ARE MENTIONED, CLASSIFIED BY THEIR SECTION NUMBER (I.E. BY SUBJECT).

FOR CROSS REFERENCING THERE IS AN INDEX BY CODE NUMBER, WHICH HAS REFERENCES TO PROCEDURE NAME AND SECTION NUMBER, AND THERE IS ALSO A KWIC INDEX IN WHICH KEYWORDS AND PROCEDURE NAMES HAVE BEEN ORDERED ALPHABETICALLY.

ORIGIN OF THE PROGRAMS.

THE MAJOR PART OF THE LIBRARY CONSISTS OF PROCEDURES THAT HAVE BEEN DEVELOPED AT THE MATHEMATICAL CENTRE. HOWEVER, SOME PROCEDURES ARE ADAPTED VERSIONS OF PROCEDURES PUBLISHED IN THE LITERATURE. IN PARTICULAR A NUMBER OF PROGRAMS ARE DERIVED FROM PROCEDURES PUBLISHED BY G.H. GOLUB AND C. REINSCH.

EDITORIAL BOARD.

NEW CONTRIBUTIONS CAN BE INSERTED IF THEY SATISFY THE STANDARDS AND IF THEY FIT INTO THE FRAMEWORK OF NUMAL. CONTRIBUTIONS CAN BE SUBMITTED TO ONE OF THE MEMBERS OF THE EDITORIAL BOARD:

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ACKNOWLEDGEMENTS.

THE LIBRARY NUMAL IS BEING DEVELOPED BY THE JOINT EFFORTS OF THE MEMBERS OF THE LIBRARY GROUP OF THE NUMERICAL MATHEMATICS DEPARTMENT OF THE MATHEMATICAL CENTRE. IN PARTICULAR, HOWEVER, WE WANT TO ACKNOWLEDGE THE MEMBERS F. GROEN, R. PISCAER AND G.J.F. VINKESTEYN, WHO TOOK CARE OF FILE MANIPULATION, EDITING OF THE DOCUMENTATION FILES AND ADAPTION AND RUNNING OF THE KWIC INDEX PROGRAM.

P.W. HEMKER
MANAGING EDITOR

P.J. VAN DER HOUWEN
HEAD OF THE DEPT. OF NUMERICAL MATHEMATICS

CLASSIFIED ACCORDING TO SUBJECT, THIS INDEX CONTAINS THE NAMES OF THE PROCEDURES AND THE CORRESPONDING CODE NUMBERS. THE DOCUMENTATION OF THE PROCEDURES IS PRESENTED IN VOLUMES 1 THROUGH 7 AND IS ARRANGED ACCORDING TO SECTION NUMBERS, HENCE REFERENCE IS IMMEDIATE.

IN ADDITION TO THE CODENUMBER AND THE NAME OF EACH PROCEDURE THE MONTH OF FIRST APPEARANCE OF THE FINAL DOCUMENTATION IS LISTED. A SEPARATE REVISION RECORD ENABLES THE USER TO CHECK WHETHER HIS MANUAL IS ACCURATELY UPDATED.

TO LOCATE A PIECE OF DOCUMENTATION IN MACHINE-READABLE FORM (E.G. FOR USE WITH THE CD CYBER 70 SYSTEM) THE SYSTEMATICAL INDEX ALSO GIVES THE RECORD NUMBER (LEVEL 0) WHERE EACH PIECE OF DOCUMENTATION CAN BE FOUND ON THE DOCUMENTATION FILE (I.E. ON TAPE).

FOR USE WITH THE CD CYBER 70 SYSTEM, THE OBJECT CODE OF THE PROCEDURES IS AVAILABLE AND IT IS CONTAINED IN THE LIBRARY FILE "NUMAL3". THIS LIBRARY FILE CAN BE USED WHEN PROGRAMS COMPILED UNDER ALGOL 3 ARE LOADED.

FOR USE OF A LIBRARY FILE SEE E.G.

CDC SCOPE REF. MANUAL, CHAPTER 6;

CDC INTERCOM REF. MANUAL, CHAPTER 3, XEQ COMMAND.

A LIBRARY FILE FOR USE WITH PROGRAMS COMPILED UNDER ALGOL 4 IS IN PREPARATION.

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	INIMAT	* 31011	APR/74	1
	INIMATD	* 31012	APR/74	1
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	INISYMRW	31014	APR/74	1
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	DUPVECRW	* 31031	APR/74	3
	DUPROWVEC	* 31032	APR/74	3
	DUPVECCOL	* 31033	APR/74	3
	DUPCOLVEC	* 31034	APR/74	3
	DUPMAT	* 31035	APR/74	3
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	MULROW	* 31021	APR/74	5
	MULCOL	* 31022	APR/74	5
	COLCST	* 31131	APR/74	5
	ROWCST	* 31132	APR/74	5
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1.VECTOR VECTOR PRODUCTS				
	VECVEC	* 34010	DEC/75	7
	MATVEC	* 34011	DEC/75	7
	TAMVEC	* 34012	DEC/75	7
	MATHAT	* 34013	DEC/75	7
	TAMHAT	* 34014	DEC/75	7
	MATTAM	* 34015	DEC/75	7
	SEQVEC	* 34016	DEC/75	7
	SCAPRD1	* 34017	DEC/75	7
	SYMHATVEC	34018	DEC/75	7
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	FULTAMVEC	* 31501	DEC/75	15
	FULSYMHATVEC	31502	DEC/75	15
	RESVEC	* 31503	DEC/75	15
	SYHRESVEC	31504	DEC/75	15
3.MATRIX MATRIX PRODUCTS				
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	HSHCOLMAT	* 31071	JAN/76	269
	HSHROWMAT	* 31072	JAN/76	269
	HSHVECTAM	* 31073	JAN/76	269
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	ELMROWVEC	* 34027	APR/74	9
	ELMCOLROW	* 34029	APR/74	9
	ELMROWCOL	* 34028	APR/74	9

1. 1. 5.

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			ICHCOL	* 34031	APR/74	11
			ICHROW	* 34032	APR/74	11
			ICHROWCOL	* 34033	APR/74	11
			ICHSEQVEC	* 34034	APR/74	11
			ICHSEQ	* 34035	APR/74	11
		7.ROTATION	ROTCOL	* 34040	APR/74	13
			ROTRON	* 34041	APR/74	13
		8.NORMS	INFNRMVEC	* 31061	OCT/75	241
			INFNRMROW	* 31062	OCT/75	241
			INFNRMCOL	* 31063	OCT/75	241
			INFNRMMAT	* 31064	OCT/75	241
			ONENRMVEC	* 31065	OCT/75	241
			ONENRMROW	* 31066	OCT/75	241
			ONENRMCOL	* 31067	OCT/75	241
			ONENRMMAT	* 31068	OCT/75	241
			ABSHAXMAT	* 31069	OCT/75	241
		9.SCALING	REASCL	34183	APR/74	17
		2.COMPL VECT AND MAT OPERATIONS				
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		2.				
		3.MULTIPLICATION	COMCOLCST	34352	MAY/74	21
			COMROWCST	34353	MAY/74	21
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			HSHCOMCOL	34355	MAY/74	23
			HSHCOMPRD	34356	MAY/74	23
		5.ELIMINATION	ELMCOMVECCOL	34376	MAY/74	25
			ELMCOMCOL	34377	MAY/74	25
			ELMCOMROWVEC	34378	MAY/74	25
		6.INTERCHANGING	ROTCOMCOL	34357	JAN/76	27
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			CHSHZ	34611	JAN/76	27
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	LNGTAMMAT	* 34414	JAN/76	39
	LNGMATTAM	* 34415	JAN/76	39
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PONCHS	31051	NOT YET AVAILABLE	
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WRITE	39998	NOT YET AVAILABLE	

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LSQDEC	34130	730901	750701	LSQRTDEC(3.1.1.2.1.1)
EKF	35020	740501	750701	ERRORFUNCTION(6.7)
KKIN	33011	740501	750701	RKE(5.2.1.1.1.1)
LINIGER1	33130	740915	750701	LINIGER1VS(5.2.1.1.1.2)
ABSMAXVEC	31060	750101	750101	INFNRHVEC(1.1.8)
MAXMAT	34230	750101	750101	ABSMAXMAT(1.1.8)
BESSELJ	35100	750101	750701	BESS J (6.9.1)
BESSELY	35101	750101	750701	BESS Y (6.9.1)
BESSELI	35102	750101	750701	BESS I (6.9.2)
BESSELK	35103	750101	750701	BESS K (6.9.2)
KG	35040	750101	750701	BESS K01 (6.9.2)
NONEXPBESSELI	35104	750101	750701	NONEXP BESS I (6.9.2)
NONEXPBESSELK	35105	750101	750701	NONEXP BESS K (6.9.2)
NONEXPK0	35038	750101	750701	NONEXP BESS K01 (6.9.2)
YA	35075	750101	750701	BESS YA01 (6.10.1)
YAPLUSN	35076	750101	750701	BESS YAPLUSN (6.10.1)
BESSELPQ	35077	750101	750701	BESS PQA01 (6.10.1)
KA	35071	750101	750701	BESS KA01 (6.10.2)
KAPLUSN	35072	750101	750701	BESS KAPLUSN (6.10.2)
NONEXPKA	35073	750101	750701	NONEXP BESS KA01(6.10.2)
NONEXPKAPLUSN	35074	750101	750701	NONEXP BESS KAPLUSN (6.10.2)

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30003	6. 2.	DWARF	* JAN/76
30004	6. 2.	GIANT	* JAN/76
30005	6. 2.	INTCAP	* JAN/76
30006	6. 1.	PI	* JAN/76
30007	6. 1.	E	* JAN/76
30008	6. 2.	OVERFLOW	* JAN/76
30009	6. 2.	UNDERFLOW	* JAN/76
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30011	6. 3.	SETRANDOM	
31010	1. 1. 1.	INIVEC	* APR/74
31011	1. 1. 1.	INIMAT	* APR/74
31012	1. 1. 1.	INIMATD	* APR/74
31013	1. 1. 1.	INISYMD	APR/74
31014	1. 1. 1.	INISYMR0W	APR/74
31020	1. 1. 3.	MULVEC	* APR/74
31021	1. 1. 3.	MULROW	* APR/74
31022	1. 1. 3.	MULCOL	* APR/74
31030	1. 1. 2.	DUPVEC	* APR/74
31031	1. 1. 2.	DUPVECROW	* APR/74
31032	1. 1. 2.	DUPROWVEC	* APR/74
31033	1. 1. 2.	DUPVECCOL	* APR/74
31034	1. 1. 2.	DUPCOLVEC	* APR/74
31035	1. 1. 2.	DUPMAT	* APR/74
31040	2. 2. 1. 1.	POL	OCT/75
31041	2. 2. 1. 2.	NEWPOL	
31042	2. 2. 2. 2.	CHEPOL	OCT/75
31043	2. 2. 2. 2.	ALLCHEPOL	OCT/75
31044	2. 2. 2. 1.	ORTPOL	
31045	2. 2. 2. 1.	ALLORTPOL	
31046	2. 2. 2. 2.	CHEPOLSER	OCT/75
31047	2. 2. 2. 1.	ORTPOLSER	
31050	2. 4. 1.	NEWGRN	DEC/75
31051	2. 4. 1.	POWCHS	
31052	2. 4. 2.	MULPOL	
31053	2. 4. 2.	ADDPOL	
31054	2. 4. 2.	SUBPOL	
31055	2. 4. 2.	DIFPOL	
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31060	OBSOLETE PROCEDURE	ABSHXVEC	
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31062	1. 1. 8.	INFNRMR0W	* OCT/75
31063	1. 1. 8.	INFNRMCOL	* OCT/75
31064	1. 1. 8.	INFNRMMAT	* OCT/75
31065	1. 1. 8.	ONENRMVEC	* OCT/75
31066	1. 1. 8.	ONENRMROW	* OCT/75
31067	1. 1. 8.	ONENRMCOL	* OCT/75
31068	1. 1. 8.	ONENRMMAT	* OCT/75
31069	1. 1. 8.	ABSHXMAT	* OCT/75
31070	1. 1. 4. 3.	HSHVECMAT	* JAN/76

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31071	1. 1. 4. 3.	HSHCOLMAT	* JAN/76
31072	1. 1. 4. 3.	HSHROWMAT	* JAN/76
31073	1. 1. 4. 3.	HSHVECTAM	* JAN/76
31074	1. 1. 4. 3.	HSHCOLTAM	* JAN/76
31075	1. 1. 4. 3.	HSHROWTAM	* JAN/76
31090	2. 2. 3. 1.	SINSER	OCT/74
31091	2. 2. 3. 1.	COSSER	OCT/74
31092	2. 2. 3. 1.	FOUSER	OCT/74
31093	2. 2. 3. 1.	FOUSER1	OCT/74
31094	2. 2. 3. 1.	FOUSER2	OCT/74
31095	2. 2. 3. 1.	COMFOUSER	OCT/74
31096	2. 2. 3. 1.	COMFOUSER1	OCT/74
31097	2. 2. 3. 1.	COMFOUSER2	OCT/74
31101	1. 5. 1.	DP ADD	* JAN/76
31102	1. 5. 1.	DP SUB	* JAN/76
31103	1. 5. 1.	DP MUL	* JAN/76
31104	1. 5. 1.	DP DIV	* JAN/76
31105	1. 5. 1.	LNG ADD	* JAN/76
31106	1. 5. 1.	LNG SUB	* JAN/76
31107	1. 5. 1.	LNG MUL	* JAN/76
31108	1. 5. 1.	LNG DIV	* JAN/76
31131	1. 1. 3.	COLCST	* APR/74
31132	1. 1. 3.	ROWCST	* APR/74
31200	1. 4.	LNGINTADD	OCT/74
31201	1. 4.	LNGINTSUBTRACT	OCT/74
31202	1. 4.	LNGINTMULT	OCT/74
31203	1. 4.	LNGINTDIVIDE	OCT/74
31204	1. 4.	LNGINTPOWER	OCT/74
31241	2. 2. 1. 1.	TAYPOL	OCT/75
31242	2. 2. 1. 1.	NORDERPOL	OCT/75
31243	2. 2. 1. 1.	DERPOL	OCT/75
31248	2. 4. 3.	INTCHS	OCT/74
31249	4. 2. 3.	RECCOF	
31250	2. 4. 1.	POLCHS	
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31362	3. 6. 2.	ALLZERORTPOL	OCT/74
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31500	1. 1. 4. 2.	FULMATVEC	* DEC/75
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31502	1. 1. 4. 2.	FULSYMMATVEC	DEC/75
31503	1. 1. 4. 2.	RESVEC	* DEC/75
31504	1. 1. 4. 2.	SYMRESVEC	DEC/75
31505	1. 5. 2. 2.	LNGFULMATVEC	* JAN/76
31506	1. 5. 2. 2.	LNGFULTAMVEC	* JAN/76
31507	1. 5. 2. 2.	LNGFULSYMMATVEC	JAN/76
31508	1. 5. 2. 2.	LNGRESVEC	* JAN/76
31509	1. 5. 2. 2.	LNGSYMRESVEC	JAN/76
32010	4. 1.	EULER	JUL/74
32020	4. 1.	SUMPOSSERIES	JUL/74

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32070	4. 2. 1.	QADRAT	JUL/74
32075	4. 2. 2.	TRICUB	OCT/75
33010	5. 2. 1. 1. 1. 1.	RK1	AUG/74
33011	OBSOLETE PROCEDURE	RK1N	
33012	5. 2. 1. 1. 2. 1.	RK2	AUG/74
33013	5. 2. 1. 1. 2. 1.	RK2N	AUG/74
33014	5. 2. 1. 1. 2. 1.	RK3	AUG/74
33015	5. 2. 1. 1. 2. 1.	RK3N	AUG/74
33016	5. 2. 1. 1. 1. 1.	RK4A	AUG/74
33017	5. 2. 1. 1. 1. 1.	RK4NA	AUG/74
33018	5. 2. 1. 1. 1. 1.	RK5NA	AUG/74
33033	5. 2. 1. 1. 1. 1.	RKE	DEC/75
33040	5. 2. 1. 1. 1. 3.	MODIFIED TAYLOR	AUG/74
33050	5. 2. 1. 1. 1. 3.	EXPONENTIALLY FITTED TAYLOR	AUG/74
33061	5. 2. 1. 1. 1. 1.	ARK	DEC/75
33070	5. 2. 1. 1. 1. 1.	EFRK	AUG/74
33080	5. 2. 1. 1. 1. 1.	MULTISTEP	AUG/74
33120	5. 2. 1. 1. 1. 2.	EFERK	AUG/74
33130	OBSOLETE PROCEDURE	LINIGER1	AUG/74
33131	5. 2. 1. 1. 1. 2.	LINIGER2	AUG/74
33132	5. 2. 1. 1. 1. 2.	LINIGER1VS	OCT/74
33135	5. 2. 1. 1. 1. 2.	IMPEX	OCT/75
33160	5. 2. 1. 1. 1. 2.	EFSIRK	AUG/74
33170	5. 2. 1. 2. 2. 1. 2.	RICHARDSON	OCT/74
33171	5. 2. 1. 2. 2. 1. 2.	ELIMINATION	OCT/74
33180	5. 2. 1. 1. 1. 1.	DIFFSYS	AUG/74
33191	5. 2. 1. 1. 1. 2.	GMS	OCT/74
33300	5. 2. 1. 2. 1. 2. 1. 1.	FEM LAG	JAN/76
33301	5. 2. 1. 2. 1. 2. 1. 1.	FEM LAG SYM	JAN/76
33302	5. 2. 1. 2. 1. 2. 1. 2.	FEM LAG SKEW	JAN/76
33303	5. 2. 1. 2. 1. 2. 2. 1.	FEM HERM SYM	JAN/76
34010	1. 1. 4. 1.	VECVEC	* DEC/75
34011	1. 1. 4. 1.	MATVEC	* DEC/75
34012	1. 1. 4. 1.	TAMVEC	* DEC/75
34013	1. 1. 4. 1.	MATMAT	* DEC/75
34014	1. 1. 4. 1.	TAMMAT	* DEC/75
34015	1. 1. 4. 1.	MATTAM	* DEC/75
34016	1. 1. 4. 1.	SEQVEC	* DEC/75
34017	1. 1. 4. 1.	SCAPRD1	* DEC/75
34018	1. 1. 4. 1.	SYMMATVEC	DEC/75
34020	1. 1. 5.	ELMVEC	* APR/74
34021	1. 1. 5.	ELMVECCOL	* APR/74
34022	1. 1. 5.	ELMCOLVEC	* APR/74
34023	1. 1. 5.	ELMCOL	* APR/74
34024	1. 1. 5.	ELMROW	* APR/74
34025	1. 1. 5.	MAXELMROW	* APR/74
34026	1. 1. 5.	ELMVECROW	* APR/74
34027	1. 1. 5.	ELMROWVEC	* APR/74
34028	1. 1. 5.	ELMROWCOL	* APR/74
34029	1. 1. 5.	ELMROWCOLROW	* APR/74

CODE	SECTION	PROCEDURE	MNT/YR
34030	1. 1. 6.	ICHVEC	* APR/74
34031	1. 1. 6.	ICHCOL	* APR/74
34032	1. 1. 6.	ICHROW	* APR/74
34033	1. 1. 6.	ICHROWCOL	* APR/74
34034	1. 1. 6.	ICHSEQVEC	* APR/74
34035	1. 1. 6.	ICHSEQ	* APR/74
34040	1. 1. 7.	ROTCOL	* APR/74
34041	1. 1. 7.	ROTRW	* APR/74
34050	OBSOLETE PROCEDURE	DET	
34051	3. 1. 1. 1. 1. 1. 3.	SOL	MAY/74
34053	3. 1. 1. 1. 1. 1. 4.	INV	MAY/74
34061	3. 1. 1. 1. 1. 1. 3.	SOLELM	MAY/74
34071	3. 1. 2. 1. 1. 1. 1. 3.	SOLBND	JUN/74
34130	OBSOLETE PROCEDURE	LSQDEC	
34131	3. 1. 1. 2. 1. 2.	LSQSOL	MAY/74
34132	3. 1. 1. 2. 1. 1.	LSQDGLINV	MAY/74
34134	3. 1. 1. 2. 1. 1.	LSQORTDEC	MAY/74
34135	3. 1. 1. 2. 1. 2.	LSQORTDECSOL	MAY/74
34136	3. 1. 1. 2. 1. 3.	LSQINV	OCT/74
34140	3. 2. 1. 2. 1. 1.	TFMSYMTRI2	JUN/74
34141	3. 2. 1. 2. 1. 1.	BAKSYMTRI2	JUN/74
34142	3. 2. 1. 2. 1. 1.	TFMPREVEC	JUN/74
34143	3. 2. 1. 2. 1. 1.	TFMSYMTRI1	JUN/74
34144	3. 2. 1. 2. 1. 1.	BAKSYMTRI1	JUN/74
34150	5. 1. 1. 1. 1.	ZEROIN	OCT/75
34151	3. 3. 1. 1. 1.	VALSYMTRI	JUL/74
34152	3. 3. 1. 1. 1.	VECSYMTRI	JUL/74
34153	3. 3. 1. 1. 2.	EIGVALSYM2	JUL/74
34154	3. 3. 1. 1. 2.	EIGSYM2	JUL/74
34155	3. 3. 1. 1. 2.	EIGVALSYM1	JUL/74
34156	3. 3. 1. 1. 2.	EIGSYM1	JUL/74
34160	3. 3. 1. 1. 1.	QRIVALSYMTRI	JUL/74
34161	3. 3. 1. 1. 1.	QRISYMTRI	JUL/74
34162	3. 3. 1. 1. 2.	QRIVALSYM2	JUL/74
34163	3. 3. 1. 1. 2.	QRISYM	JUL/74
34164	3. 3. 1. 1. 2.	QRIVALSYM1	JUL/74
34166	3. 3. 1. 1. 1.	RATQRI	
34170	3. 2. 1. 2. 1. 2.	TFMREAHEs	JUN/74
34171	3. 2. 1. 2. 1. 2.	BAKREAHEs1	JUN/74
34172	3. 2. 1. 2. 1. 2.	BAKREAHEs2	JUN/74
34173	3. 2. 1. 1. 1.	EQILBR	JUN/74
34174	3. 2. 1. 1. 1.	BAKLBR	JUN/74
34180	3. 3. 1. 2. 1.	REAVALQRI	JUL/74
34181	3. 3. 1. 2. 1.	REAVECHES	JUL/74
34182	3. 3. 1. 2. 2.	REAEIGVAL	JUL/74
34183	1. 1. 9.	REASCL	APR/74
34184	3. 3. 1. 2. 2.	REAEIG1	JUL/74
34185	3. 3. 1. 2. 2.	REAEIG2	
34186	3. 3. 1. 2. 1.	REAQRI	JUL/74
34187	3. 3. 1. 2. 2.	REAEIG3	JUL/74
34190	3. 3. 1. 2. 1.	COMVALQRI	JUL/74

CODE	SECTION	PROCEDURE	MNT/YR
34191	3. 3. 1. 2. 1.	COMVECHES	JUL/74
34192	3. 3. 1. 2. 2.	COMEIGVAL	JUL/74
34193	1. 2. 9.	COMSCL	DEC/75
34194	3. 3. 1. 2. 2.	COMEIG1	JUL/74
34195	3. 3. 1. 2. 2.	COMEIG2	
34200	5. 1. 1. 2. 3.	DAMPED NEWTON	
34202	5. 1. 1. 2. 3.	NEWRAP	
34203	5. 1. 2. 2. 4.	NEWTONMIN	
34210	5. 1. 2. 2. 1.	LINEMIN	DEC/75
34211	5. 1. 2. 2. 1.	RNK1UPD	DEC/75
34212	5. 1. 2. 2. 1.	DAVUPD	DEC/75
34213	5. 1. 2. 2. 1.	FLEUPD	DEC/75
34214	5. 1. 2. 2. 3.	RNK1MIN	DEC/75
34215	5. 1. 2. 2. 3.	FLEMIN	DEC/75
34220	3. 1. 2. 2. 1.	CONJ GRAD	JUN/74
34221	3. 1. 2. 2. 1.	CONJ RESI	
34230	OBSOLETE PROCEDURE	MAXMAT	
34231	3. 1. 1. 1. 1. 1. 1.	GSSELM	MAY/74
34232	3. 1. 1. 1. 1. 1. 3.	GSSSOL	MAY/74
34235	3. 1. 1. 1. 1. 1. 4.	INV1	MAY/74
34236	3. 1. 1. 1. 1. 1. 4.	GSSINV	MAY/74
34240	3. 1. 1. 1. 1. 1. 1.	ONENRMINV	MAY/74
34241	3. 1. 1. 1. 1. 1. 1.	ERBELM	MAY/74
34242	3. 1. 1. 1. 1. 1. 1.	GSSERB	MAY/74
34243	3. 1. 1. 1. 1. 1. 3.	GSSSOLERB	MAY/74
34244	3. 1. 1. 1. 1. 1. 4.	GSSINVERB	MAY/74
34250	3. 1. 1. 1. 1. 1. 5.	ITISOL	MAY/74
34251	3. 1. 1. 1. 1. 1. 5.	GSSITISOL	MAY/74
34252	3. 1. 1. 1. 1. 1. 1.	GSSNRI	MAY/74
34253	3. 1. 1. 1. 1. 1. 5.	ITISOLERB	MAY/74
34254	3. 1. 1. 1. 1. 1. 5.	GSSITISOLERB	MAY/74
34260	3. 2. 2. 1. 1.	HSHREABID	JUN/74
34261	3. 2. 2. 1. 1.	PSTTFMMAT	JUN/74
34262	3. 2. 2. 1. 1.	PRETFMMAT	JUN/74
34270	3. 5. 1. 1.	QRISNGVALBID	JUL/74
34271	3. 5. 1. 1.	QRISNGVALDEC BID	JUL/74
34272	3. 5. 1. 2.	QRISNGVAL	JUL/74
34273	3. 5. 1. 2.	QRISNGVALDEC	JUL/74
34280	3. 1. 1. 3. 1. 1.	SOLSVD OVR	MAY/74
34281	3. 1. 1. 3. 1. 1.	SOLOVR	MAY/74
34282	3. 1. 1. 3. 1. 2.	SOLSVDUND	MAY/74
34283	3. 1. 1. 3. 1. 2.	SOLUND	MAY/74
34284	3. 1. 1. 3. 1. 3.	HOMSOLSVD	MAY/74
34285	3. 1. 1. 3. 1. 3.	HOMSOL	MAY/74
34286	3. 1. 1. 3. 1. 4.	PSDINVSVD	MAY/74
34287	3. 1. 1. 3. 1. 4.	PSDINV	MAY/74
34300	3. 1. 1. 1. 1. 1. 1.	DEC	MAY/74
34301	3. 1. 1. 1. 1. 1. 3.	DECSOL	MAY/74
34302	3. 1. 1. 1. 1. 1. 4.	DECINV	MAY/74
34303	3. 1. 1. 1. 1. 1. 2.	DETERM	MAY/74
34310	3. 1. 1. 1. 1. 2. 1.	CHLDEC2	MAY/74

CODE	SECTION	PROCEDURE	MNT/YR
34311	3. 1. 1. 1. 1. 2. 1.	CHLDEC1	MAY/74
34312	3. 1. 1. 1. 1. 2. 2.	CHLDETERM2	MAY/74
34313	3. 1. 1. 1. 1. 2. 2.	CHLDETERM1	MAY/74
34320	3. 1. 2. 1. 1. 1. 1. 1.	DECBND	JUN/74
34321	3. 1. 2. 1. 1. 1. 1. 2.	DETERMBND	JUN/74
34322	3. 1. 2. 1. 1. 1. 1. 3.	DECSOLBND	JUN/74
34330	3. 1. 2. 1. 1. 2. 1. 1.	CHLDECBND	JUN/74
34331	3. 1. 2. 1. 1. 2. 1. 2.	CHLDETERMBND	JUN/74
34332	3. 1. 2. 1. 1. 2. 1. 3.	CHLSOLBND	JUN/74
34333	3. 1. 2. 1. 1. 2. 1. 3.	CHLDECSOLBND	JUN/74
34340	1. 3. 1.	COMABS	MAY/74
34341	1. 3. 2.	COMMUL	MAY/74
34342	1. 3. 2.	COMDIV	MAY/74
34343	1. 3. 1.	COMSQRT	MAY/74
34344	1. 3. 1.	CARPOL	MAY/74
34345	3. 6. 3.	COMKWD	JUL/74
34352	1. 2. 3.	COMCOLCST	MAY/74
34353	1. 2. 3.	COMROWCST	MAY/74
34354	1. 2. 4.	COMMATVEC	MAY/74
34355	1. 2. 4.	HSHCOMCOL	MAY/74
34356	1. 2. 4.	HSHCOMPRD	MAY/74
34357	1. 2. 7.	ROTCOMCOL	JAN/76
34358	1. 2. 7.	ROTCOMROW	JAN/76
34359	1. 2. 8.	COMEUCNRM	DEC/75
34360	1. 2. 9.	SCLCOM	DEC/75
34361	3. 2. 1. 1. 2.	EQILBRCOM	JUN/74
34362	3. 2. 1. 1. 2.	BAKLBRCOM	JUN/74
34363	3. 2. 1. 2. 2. 1.	HSHHRMTRI	JUN/74
34364	3. 2. 1. 2. 2. 1.	HSHHRMTRIVAL	JUN/74
34365	3. 2. 1. 2. 2. 1.	BAKHRMTRI	JUN/74
34366	3. 2. 1. 2. 2. 2.	HSHCOMHES	JUN/74
34367	3. 2. 1. 2. 2. 2.	BAKCOMHES	JUN/74
34368	3. 3. 2. 1.	EIGVALHRM	JUL/74
34369	3. 3. 2. 1.	EIGHRM	JUL/74
34370	3. 3. 2. 1.	QRIVALHRM	JUL/74
34371	3. 3. 2. 1.	QRIHRM	JUL/74
34372	3. 3. 2. 2. 1.	VALQRICOM	JUL/74
34373	3. 3. 2. 2. 1.	QRICOM	JUL/74
34374	3. 3. 2. 2. 2.	EIGVALCOM	JUL/74
34375	3. 3. 2. 2. 2.	EIGCOM	JUL/74
34376	1. 2. 5.	ELMCOMVECCOL	MAY/74
34377	1. 2. 5.	ELMCOMCOL	MAY/74
34378	1. 2. 5.	ELMCOMROWVEC	MAY/74
34390	3. 1. 1. 1. 1. 2. 3.	CHLSOL2	MAY/74
34391	3. 1. 1. 1. 1. 2. 3.	CHLSOL1	MAY/74
34392	3. 1. 1. 1. 1. 2. 3.	CHLDECSOL2	MAY/74
34393	3. 1. 1. 1. 1. 2. 3.	CHLDECSOL1	MAY/74
34400	3. 1. 1. 1. 1. 2. 4.	CHLINV2	MAY/74
34401	3. 1. 1. 1. 1. 2. 4.	CHLINV1	MAY/74
34402	3. 1. 1. 1. 1. 2. 4.	CHLDECINV2	MAY/74
34403	3. 1. 1. 1. 1. 2. 4.	CHLDECINV1	MAY/74

CODE	SECTION	PROCEDURE	MNT/YR
34410	1. 5. 2. 1.	LNGVECVEC	* JAN/76
34411	1. 5. 2. 1.	LNGMATVEC	* JAN/76
34412	1. 5. 2. 1.	LNGTAMVEC	* JAN/76
34413	1. 5. 2. 1.	LNGMATMAT	* JAN/76
34414	1. 5. 2. 1.	LNGTAMMAT	* JAN/76
34415	1. 5. 2. 1.	LNGMATTAM	* JAN/76
34416	1. 5. 2. 1.	LNGSEQVEC	* JAN/76
34417	1. 5. 2. 1.	LNGSCAPRD1	* JAN/76
34418	1. 5. 2. 1.	LNGSYMMATVEC	JAN/76
34420	3. 1. 2. 1. 1. 2. 2. 1.	DECSYMTRI	JUN/74
34421	3. 1. 2. 1. 1. 2. 2. 3.	SOLSYMTRI	JUN/74
34422	3. 1. 2. 1. 1. 2. 2. 3.	DECSOLSYMTRI	JUN/74
34423	3. 1. 2. 1. 1. 1. 2. 1.	DECTRI	JUN/74
34424	3. 1. 2. 1. 1. 1. 2. 3.	SOLTRI	JUN/74
34425	3. 1. 2. 1. 1. 1. 2. 3.	DECSOLTRI	JUN/74
34426	3. 1. 2. 1. 1. 1. 2. 1.	DECTRIPIV	JUN/74
34427	3. 1. 2. 1. 1. 1. 2. 3.	SOLTRIPIV	JUN/74
34428	3. 1. 2. 1. 1. 1. 2. 3.	DECSOLTRIPIV	JUN/74
34430	5. 1. 1. 2. 2.	QUANEWBND	OCT/74
34431	5. 1. 1. 2. 2.	QUANEWBND1	OCT/74
34432	5. 1. 2. 2. 2.	PRAXIS	OCT/75
34433	5. 1. 2. 1. 1.	MININ	OCT/75
34435	5. 1. 2. 1. 2.	MININDER	OCT/75
34436	5. 1. 1. 1. 1.	ZEROINRAT	OCT/75
34437	4. 3. 2. 1.	JACOBNNF	OCT/74
34438	4. 3. 2. 1.	JACOBNMF	OCT/74
34439	4. 3. 2. 1.	JACOBNBNDF	OCT/74
34440	5. 1. 3. 1. 3.	MARQUARDT	DEC/75
34441	5. 1. 3. 1. 3.	GSSNEWTON	DEC/75
34444	5. 2. 1. 3. 1.	PEIDE	OCT/75
34450	5. 1. 1. 2. 2.	BROWNLIS	
34451	5. 1. 1. 2. 2.	QUANEW	
34452	5. 1. 1. 2. 2.	QUANEW1	
34453	5. 1. 1. 1. 2.	ZEROINDER	OCT/75
34500	3. 6. 1.	POLZEROS	OCT/74
34600	3. 4. 1. 2.	QZIVAL	JAN/76
34601	3. 4. 1. 2.	QZI	JAN/76
34602	3. 4. 1. 2.	HSHDECMUL	JAN/76
34603	3. 4. 1. 2.	HSTGL3	JAN/76
34604	3. 4. 1. 2.	HSTGL2	JAN/76
34605	3. 4. 1. 2.	HSH2COL	JAN/76
34606	3. 4. 1. 2.	HSH3COL	JAN/76
34607	3. 4. 1. 2.	HSH2ROW3	JAN/76
34608	3. 4. 1. 2.	HSH2ROW2	JAN/76
34609	3. 4. 1. 2.	HSH3ROW3	JAN/76
34610	3. 4. 1. 2.	HSH3ROW2	JAN/76
34611	1. 2. 7.	CHSH2	JAN/76
34700	3. 1. 1. 1. 1. 3. 1.	SYMDEC2	JAN/76
34701	3. 1. 1. 1. 1. 3. 1.	SYMDEC1	JAN/76
34702	3. 1. 1. 1. 1. 3. 2.	SYMDETERM2	JAN/76
34703	3. 1. 1. 1. 1. 3. 2.	SYMDETERM1	JAN/76

CODE	SECTION	PROCEDURE	MNT/YR
34311	3. 1. 1. 1. 1. 2. 1.	CHLDEC1	MAY/74
34312	3. 1. 1. 1. 1. 2. 2.	CHLDETERM2	MAY/74
34313	3. 1. 1. 1. 1. 2. 2.	CHLDETERM1	MAY/74
34320	3. 1. 2. 1. 1. 1. 1. 1.	DECBND	JUN/74
34321	3. 1. 2. 1. 1. 1. 1. 2.	DETERMBND	JUN/74
34322	3. 1. 2. 1. 1. 1. 1. 3.	DECSOLBND	JUN/74
34330	3. 1. 2. 1. 1. 2. 1. 1.	CHLDECBND	JUN/74
34331	3. 1. 2. 1. 1. 2. 1. 2.	CHLDETERMBND	JUN/74
34332	3. 1. 2. 1. 1. 2. 1. 3.	CHLSOLBND	JUN/74
34333	3. 1. 2. 1. 1. 2. 1. 3.	CHLDECSOLBND	JUN/74
34340	1. 3. 1.	COMABS	MAY/74
34341	1. 3. 2.	COMMUL	MAY/74
34342	1. 3. 2.	COMDIV	MAY/74
34343	1. 3. 1.	COMSQT	MAY/74
34344	1. 3. 1.	CARPOL	MAY/74
34345	3. 6. 3.	COMKWD	JUL/74
34352	1. 2. 3.	COMCOLCST	MAY/74
34353	1. 2. 3.	COMROWCST	MAY/74
34354	1. 2. 4.	COMMATVEC	MAY/74
34355	1. 2. 4.	HSHCOMCOL	MAY/74
34356	1. 2. 4.	HSHCOMPRD	MAY/74
34357	1. 2. 7.	ROTCOMCOL	JAN/76
34358	1. 2. 7.	ROTCOMROW	JAN/76
34359	1. 2. 8.	COMEUCNRM	DEC/75
34360	1. 2. 9.	SCLCOM	DEC/75
14361	3. 2. 1. 1. 2.	EQILBRCOM	JUN/74
14362	3. 2. 1. 1. 2.	BAKLBRCOM	JUN/74
34363	3. 2. 1. 2. 2. 1.	HSHHRMTRI	JUN/74
34364	3. 2. 1. 2. 2. 1.	HSHHRMTRIVAL	JUN/74
34365	3. 2. 1. 2. 2. 1.	BAKHRMTRI	JUN/74
34366	3. 2. 1. 2. 2. 2.	HSHCOMHES	JUN/74
34367	3. 2. 1. 2. 2. 2.	BAKCOMHES	JUN/74
34368	3. 3. 2. 1.	EIGVALHRM	JUL/74
34369	3. 3. 2. 1.	EIGHRM	JUL/74
34370	3. 3. 2. 1.	QRIVALHRM	JUL/74
34371	3. 3. 2. 1.	QRHRM	JUL/74
34372	3. 3. 2. 2. 1.	VALQRICOM	JUL/74
34373	3. 3. 2. 2. 1.	QRICOM	JUL/74
34374	3. 3. 2. 2. 2.	EIGVALCOM	JUL/74
34375	3. 3. 2. 2. 2.	EIGCOM	JUL/74
34376	1. 2. 5.	ELMCOMVECCOL	MAY/74
34377	1. 2. 5.	ELMCOMCOL	MAY/74
34378	1. 2. 5.	ELMCOMROWVEC	MAY/74
34390	3. 1. 1. 1. 1. 2. 3.	CHLSOL2	MAY/74
34391	3. 1. 1. 1. 1. 2. 3.	CHLSOL1	MAY/74
34392	3. 1. 1. 1. 1. 2. 3.	CHLDECSOL2	MAY/74
34393	3. 1. 1. 1. 1. 2. 3.	CHLDECSOL1	MAY/74
34400	3. 1. 1. 1. 1. 2. 4.	CHLINV2	MAY/74
34401	3. 1. 1. 1. 1. 2. 4.	CHLINV1	MAY/74
34402	3. 1. 1. 1. 1. 2. 4.	CHLDECINV2	MAY/74
34403	3. 1. 1. 1. 1. 2. 4.	CHLDECINV1	MAY/74

CODE	SECTION	PROCEDURE	MNT/YR
34410	1. 5. 2. 1.	LNGVECVEC	* JAN/76
34411	1. 5. 2. 1.	LNGMATVEC	* JAN/76
34412	1. 5. 2. 1.	LNGTAMVEC	* JAN/76
34413	1. 5. 2. 1.	LNGMATMAT	* JAN/76
34414	1. 5. 2. 1.	LNGTAMMAT	* JAN/76
34415	1. 5. 2. 1.	LNGMATTAM	* JAN/76
34416	1. 5. 2. 1.	LNGSEQVEC	* JAN/76
34417	1. 5. 2. 1.	LNGSCAPRD1	* JAN/76
34418	1. 5. 2. 1.	LNGSYMMATVEC	JAN/76
34420	3. 1. 2. 1. 1. 2. 2. 1.	DECSYMTRI	JUN/74
34421	3. 1. 2. 1. 1. 2. 2. 3.	SOLSYMTRI	JUN/74
34422	3. 1. 2. 1. 1. 2. 2. 3.	DECSOLSYMTRI	JUN/74
34423	3. 1. 2. 1. 1. 1. 2. 1.	DECTRI	JUN/74
34424	3. 1. 2. 1. 1. 1. 2. 3.	SOLTRI	JUN/74
34425	3. 1. 2. 1. 1. 1. 2. 3.	DECSOLTRI	JUN/74
34426	3. 1. 2. 1. 1. 1. 2. 1.	DECTRIPIV	JUN/74
34427	3. 1. 2. 1. 1. 1. 2. 3.	SOLTRIPIV	JUN/74
34428	3. 1. 2. 1. 1. 1. 2. 3.	DECSOLTRIPIV	JUN/74
34430	5. 1. 1. 2. 2.	QUANEWBD	OCT/74
34431	5. 1. 1. 2. 2.	QUANEWBD1	OCT/74
34432	5. 1. 2. 2. 2.	PRAXIS	OCT/75
34433	5. 1. 2. 1. 1.	MININ	OCT/75
34435	5. 1. 2. 1. 2.	MININDER	OCT/75
34436	5. 1. 1. 1. 1.	ZEROINRAT	OCT/75
34437	4. 3. 2. 1.	JACOBNNF	OCT/74
34438	4. 3. 2. 1.	JACOBNMF	OCT/74
34439	4. 3. 2. 1.	JACOBNBDF	OCT/74
34440	5. 1. 3. 1. 3.	MARQUARDT	DEC/75
34441	5. 1. 3. 1. 3.	GSSNEWTON	DEC/75
34444	5. 2. 1. 3. 1.	PEIDE	OCT/75
34450	5. 1. 1. 2. 2.	BROWNLS	
34451	5. 1. 1. 2. 2.	QUANEW	
34452	5. 1. 1. 2. 2.	QUANEW1	
34453	5. 1. 1. 1. 2.	ZEROINDER	OCT/75
34500	3. 6. 1.	POLZEROS	OCT/74
34600	3. 4. 1. 2.	QZIVAL	JAN/76
34601	3. 4. 1. 2.	QZI	JAN/76
34602	3. 4. 1. 2.	HSHDECMUL	JAN/76
34603	3. 4. 1. 2.	HESTGL3	JAN/76
34604	3. 4. 1. 2.	HESTGL2	JAN/76
34605	3. 4. 1. 2.	HSH2COL	JAN/76
34606	3. 4. 1. 2.	HSH3COL	JAN/76
34607	3. 4. 1. 2.	HSH2ROW3	JAN/76
34608	3. 4. 1. 2.	HSH2ROW2	JAN/76
34609	3. 4. 1. 2.	HSH3ROW3	JAN/76
34610	3. 4. 1. 2.	HSH3ROW2	JAN/76
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34701	3. 1. 1. 1. 1. 3. 1.	SYMDEC1	JAN/76
34702	3. 1. 1. 1. 1. 3. 2.	SYMDETERM2	JAN/76
34703	3. 1. 1. 1. 1. 3. 2.	SYMDETERM1	JAN/76

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34705	3. 1. 1. 1. 1. 3. 3.	SYMSOL1	JAN/76
34706	3. 1. 1. 1. 1. 3. 3.	SYMDECSOL2	JAN/76
34707	3. 1. 1. 1. 1. 3. 3.	SYMDECSOL1	JAN/76
34708	3. 1. 1. 1. 1. 3. 4.	SYMINV2	JAN/76
34709	3. 1. 1. 1. 1. 3. 4.	SYMINV1	JAN/76
34710	3. 1. 1. 1. 1. 3. 4.	SYMDECINV2	JAN/76
34711	3. 1. 1. 1. 1. 3. 4.	SYMDECINV1	JAN/76
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35021	6. 7.	ERRORFUNCTION	OCT/74
35022	6. 7.	NONEXPERFC	OCT/74
35023	6. 7.	INVERSE ERROR FUNCTION	OCT/74
35027	6. 7.	FRESNEL	OCT/74
35028	6. 7.	FG	OCT/74
35030	6. 6.	INCOMGAM	SEP/74
35038	OBSOLETE PROCEDURE	NONEXPK0	
35040	OBSOLETE PROCEDURE	K0	
35050	6. 6.	INCBETA	SEP/74
35051	6. 6.	IBPPLUSN	SEP/74
35052	6. 6.	IBQPLUSN	SEP/74
35053	6. 6.	IXQFIX	SEP/74
35054	6. 6.	IXPFIX	SEP/74
35055	6. 6.	FORWARD	SEP/74
35056	6. 6.	BACKWARD	SEP/74
35060	6. 6.	RECIP GAMMA	SEP/74
35061	6. 6.	GAMMA	SEP/74
35062	6. 6.	LOG GAMMA	SEP/74
35071	OBSOLETE PROCEDURE	KA	
35072	OBSOLETE PROCEDURE	KAPLUSN	
35073	OBSOLETE PROCEDURE	NONEXPKA	
35074	OBSOLETE PROCEDURE	NONEXPKAPLUSN	
35075	OBSOLETE PROCEDURE	YA	
35076	OBSOLETE PROCEDURE	YAPLUSN	
35077	OBSOLETE PROCEDURE	BESSELPQ	
35080	6. 5. 1.	EI	SEP/74
35081	6. 5. 1.	EI ALPHA	SEP/74
35083	2. 3.	JFRAC	MAY/74
35084	6. 5. 2.	SINCOSINT	SEP/74
35085	6. 5. 2.	SINCOSFG	SEP/74
35086	6. 5. 1.	ENX	SEP/74
35087	6. 5. 1.	NONEXP ENX	SEP/74
35100	OBSOLETE PROCEDURE	BESSELJ	
35101	OBSOLETE PROCEDURE	BESSELY	
35102	OBSOLETE PROCEDURE	BESSELI	
35103	OBSOLETE PROCEDURE	BESSELK	
35104	OBSOLETE PROCEDURE	NONEXPBESSELI	
35105	OBSOLETE PROCEDURE	NONEXPBESSELK	
35111	6. 4. 2.	SINH	SEP/74
35112	6. 4. 2.	COSH	SEP/74
35113	6. 4. 2.	TANH	SEP/74
35114	6. 4. 2.	ARCSINH	SEP/74

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35116	6. 4. 2.	ARCTANH	SEP/74
35120	6. 4. 1.	TAN	SEP/74
35121	6. 4. 1.	ARCSIN	SEP/74
35122	6. 4. 1.	ARCCOS	SEP/74
35140	6.10. 4.	AIRY	OCT/75
35145	6.10. 4.	AIRYZEROS	OCT/75
35150	6.10. 3.	SPHER BESS J	OCT/75
35151	6.10. 3.	SPHER BESS Y	OCT/75
35152	6.10. 3.	SPHER BESS I	OCT/75
35153	6.10. 3.	SPHER BESS K	OCT/75
35154	6.10. 3.	NONEXP SPHER BESS I	OCT/75
35155	6.10. 3.	NONEXP SPHER BESS K	OCT/75
35160	6. 9. 1.	BESS J0	OCT/75
35161	6. 9. 1.	BESS J1	OCT/75
35162	6. 9. 1.	BESS J	OCT/75
35163	6. 9. 1.	BESS Y01	OCT/75
35164	6. 9. 1.	BESS Y	OCT/75
35165	6. 9. 1.	BESS PQ0	OCT/75
35166	6. 9. 1.	BESS PQ1	OCT/75
35170	6. 9. 2.	BESS I0	OCT/75
35171	6. 9. 2.	BESS I1	OCT/75
35172	6. 9. 2.	BESS I	OCT/75
35173	6. 9. 2.	BESS K01	OCT/75
35174	6. 9. 2.	BESS K	OCT/75
35175	6. 9. 2.	NONEXP BESS I0	OCT/75
35176	6. 9. 2.	NONEXP BESS I1	OCT/75
35177	6. 9. 2.	NONEXP BESS I	OCT/75
35178	6. 9. 2.	NONEXP BESS K01	OCT/75
35179	6. 9. 2.	NONEXP BESS K	OCT/75
35180	6.10. 1.	BESS JAPLUSN	OCT/75
35181	6.10. 1.	BESS YA01	OCT/75
35182	6.10. 1.	BESS YAPLUSN	OCT/75
35183	6.10. 1.	BESS PQA01	OCT/75
35190	6.10. 2.	BESS IAPLUSN	OCT/75
35191	6.10. 2.	BESS KA01	OCT/75
35192	6.10. 2.	BESS KAPLUSN	OCT/75
35193	6.10. 2.	NONEXP BESS IAPLUSN	OCT/75
35194	6.10. 2.	NONEXP BESS KA01	OCT/75
35195	6.10. 2.	NONEXP BESS KAPLUSN	OCT/75
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36022	7. 1. 3. 2. 1.	MINMAXPOL	OCT/75
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39999	9.	READ	

IN THIS KEY WORD IN CONTEXT (KWIC) INDEX KEY WORDS AND PROCEDURE NAMES ARE ORDERED ALPHABETICALLY.

THE KWIC INDEX IS BASED UPON PROGRAM ABSTRACT SUCH AS:

32070 #QADRAT (#QUADRATURE) COMPUTES THE #DEFINITE #INTEGRAL OF A #FUNCTION OF ONE VARIABLE OVER A FINITE INTERVAL.

THE ABSTRACT COMPRISES THE CODE NUMBER AND A SHORT DESCRIPTION OF THE PROGRAM (ITS NAME, WHAT IT DOES, AND HOW IT DOES IT).

THE "IMPORTANT" WORDS (PRECEDED BY A # IN THE ABOVE EXAMPLE) ARE USED AS KEY WORDS IN THE KWIC INDEX.

THE FIRST APPEARANCE OF OUR ABOVE EXAMPLE ABSTRACT IN THE KWIC INDEX IS:

QADRAT COMPUTES THE .DEFINITE INTEGRAL OF A FUNCTION OF ONE VARIABLE OVER A FINITE INTERVAL. 32070 133

IF THIS PROGRAM (QADRAT) IS OF INTEREST, YOU CAN LOCATE IT BY MEANS OF ITS CODE NUMBER (32070).

IN CASE AN ENTRY IN THE KWIC INDEX IS NOT COMPLETELY READABLE (I.E. TRUNCATED AT AN END OF THE LINE), YOU CAN FIND A COMPLETE LISTING (BY CODE NUMBER) OF ALL THE ABSTRACTS FOLLOWING THE KWIC INDEX.

SINCE ALL PROCEDURE NAMES HAVE BEEN INSERTED AS KEYWORDS, THE KWIC INDEX CAN ALSO BE USED TO TRACE A PROCEDURE BY ITS NAME.

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ELMCOL	ADDS A CONSTANT TIMES A COLUMN VECTOR TO A COLUMN VECTOR.	34023 9
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CALCULATES THE MODULUS OF THE			
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LSQORTECSOL SOLVES A LINEAR			
LSQSOL SOLVES A LINEAR			
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COEFFICIENT MATRIX OF A LINEAR			
MARQUARDT CALCULATES THE			
GSSNEWTON CALCULATES THE			
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OLVES A TRIDIAGONAL SYSTEM OF			
MHMETRIC TRIDIAGONAL SYSTEM OF			
GSSITISOL SOLVES A SYSTEM OF			
DEFINITE SYMMETRIC SYSTEM OF			
DEFINITE SYMMETRIC SYSTEM OF			
DECSOLBND SOLVES A SYSTEM OF			
SOLVES A SYMMETRIC SYSTEM OF			
SOLVES A SYMMETRIC SYSTEM OF			
DEFINITE SYMMETRIC SYSTEM OF			
DEFINITE SYMMETRIC SYSTEM OF			
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	LNGFULMATVEC CALCULATES BY DOUBLE PRECISION ARITHMETIC THE PRODUCT $A * B$, WHERE A IS A GIV	31505	285
	LNGFULSYMATVEC CALCULATES BY DOUBLE PRECISION ARITHMETIC THE PRODUCT $A * B$, WHERE A IS A	31507	285
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	LNGINTADD COMPUTES THE SUM OF LONG NONNEGATIVE INTEGERS.	31200	201
	LNGINTDIVIDE COMPUTES THE QUOTIENT WITH REMAINDER OF LONG NONNEGATIVE INTEGERS.	31203	201
	LNGINTMULT COMPUTES THE PRODUCT OF LONG NONNEGATIVE INTEGERS.	31202	201
	LNGINTPOWER COMPUTES $U**POWER$, WHERE U IS A LONG NONNEGATIVE INTEGER AND POWER IS THE POSI	31204	201
	LNGINTSUBTRACT COMPUTES THE DIFFERENCE OF LONG NONNEGATIVE INTEGERS.	31201	201
	LNGMATMAT CALCULATES THE SCALAR PRODUCT OF A ROW OF A VECTOR AND A COLUMN VECTOR BY DOUBLE	34413	39
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	LNGHATVEC CALCULATES THE SCALAR PRODUCT OF A VECTOR AND A ROW VECTOR BY DOUBLE PRECISION A	34411	39
	LNGHUL MULTIPLIES TWO DOUBLE PRECISION NUMBERS.	31107	271
	LNGRESVEC CALCULATES BY DOUBLE PRECISION ARITHMETIC THE RESIDUAL VECTOR $A * B + X * C$, WHE	31508	285
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	LNGTAMMAT CALCULATES THE SCALAR PRODUCT OF TWO COLUMN VECTORS BY DOUBLE PRECISION ARITHMET	34414	39

GAMMA CALCULATES THE NATURAL LOGARITHM OF THE GAMMA FUNCTION FOR POSITIVE ARGUMENTS.
 HPUTES U**POWER, WHERE U IS A POSITIVE REAL NUMBER AND POWER IS THE POSITIVE (SINGLE-LENGTH) EXPONENT.
 LNGINTADD COMPUTES THE SUM OF TWO LONG NONNEGATIVE INTEGERS.
 CT COMPUTES THE DIFFERENCE OF TWO LONG NONNEGATIVE INTEGERS.
 TMULT COMPUTES THE PRODUCT OF TWO LONG NONNEGATIVE INTEGERS.
 HE QUOTIENT WITH REMAINDER OF TWO LONG NONNEGATIVE INTEGERS.

DUPMAT COPIES A MATRIX.
 OMPRO PREMULTIPLIES A MATRIX WITH A MATRIX.
 INIMAT INITIALIZES A MATRIX WITH A CONSTANT.
 ULATES THE INFINITY-NORM OF A MATRIX.
 AT CALCULATES THE 1-NORM OF A MATRIX.

A ROW VECTOR TO A ROW VECTOR.

MININ
 MININDER
 LINEMIN
 RNKIMIN
 FLEMIN
 PRAXIS

BESS I1 CALCULATES THE MODIFIED BESSEL FUNCTION OF THE 1ST KIND OF ORDER ONE.
 NONEXP BESS I1 CALCULATES THE MODIFIED BESSEL FUNCTION OF THE 1ST KIND OF ORDER ONE; THE RESULT IS MULTIPLIED BY EXP(-ABS(X)).
 BESS I0 CALCULATES THE MODIFIED BESSEL FUNCTION OF THE 1ST KIND OF ORDER ZERO.
 NONEXP BESS I0 CALCULATES THE MODIFIED BESSEL FUNCTION OF THE 1ST KIND OF ORDER ZERO; THE RESULT IS MULTIPLIED BY EXP(-ABS(X)).
 BESS IAPLUSN CALCULATES THE MODIFIED BESSEL FUNCTIONS OF THE 1ST KIND OF ORDER A+N, N=0,...,NMAX, A>=0 AND ARGUMENT X.
 P BESS IAPLUSN CALCULATES THE MODIFIED BESSEL FUNCTIONS OF THE 1ST KIND OF ORDER A+N, N=0,...,NMAX, A>=0 AND ARGUMENT X.
 BESS I CALCULATES THE MODIFIED BESSEL FUNCTIONS OF THE 1ST KIND OF ORDER L (L = 0,...,N).
 NONEXP BESS I CALCULATES THE MODIFIED BESSEL FUNCTIONS OF THE 1ST KIND OF ORDER L (L = 0,...,N); THE RESULT IS MULTIPLIED BY EXP(-ABS(X)).
 NEXP BESS KAD1 CALCULATES THE MODIFIED BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER A AND A+1, A>=0 AND ARGUMENT X, X>0, MU=1.
 BESS KAD1 CALCULATES THE MODIFIED BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER A AND A+1, A>=0, AND ARGUMENT X, X>0.
 P BESS KAPLUSN CALCULATES THE MODIFIED BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER A+N, N=0,...,NMAX, A>=0 AND ARGUMENT X.
 BESS KAPLUSN CALCULATES THE MODIFIED BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER A+N, N=0,...,NMAX, A>=0, AND ARGUMENT X.
 BESS K CALCULATES THE MODIFIED BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER L (L = 0,...,N) WITH ARGUMENT X, X > 0.
 NONEXP BESS K CALCULATES THE MODIFIED BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER L (L = 0,...,N) WITH ARGUMENT X, X > 0; THE RESULT IS MULTIPLIED BY EXP(-X).
 ONEXP BESS K01 CALCULATES THE MODIFIED BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER ZERO AND ONE WITH ARGUMENT X, X>0; THE RESULT IS MULTIPLIED BY EXP(-X).
 BESS K01 CALCULATES THE MODIFIED BESSEL FUNCTIONS OF THE 3RD KIND OF ORDERS ZERO AND ONE WITH ARGUMENT X, X > 0.
 P SPHER BESS I CALCULATES THE MODIFIED SPHERICAL BESSEL FUNCTIONS OF THE 1ST KIND MULTIPLIED BY EXP(-X); I(K+.5)(X)*SQRT(I(K+.5)(X)).
 SPHER BESS I CALCULATES THE MODIFIED SPHERICAL BESSEL FUNCTIONS OF THE 1ST KIND: I(K+.5)(X)*SQRT(PI/(2*X)), K=0,...,N.
 P SPHER BESS K CALCULATES THE MODIFIED SPHERICAL BESSEL FUNCTIONS OF THE 3RD KIND MULTIPLIED BY EXP(+X); K(I+.5)(X)*SQRT(I(I+.5)(X)).
 SPHER BESS K CALCULATES THE MODIFIED SPHERICAL BESSEL FUNCTIONS OF THE 3RD KIND: K(I+.5)(X)*SQRT(PI/(2*X)), I=0,...,N.

LNGTAMVEC CALCULATES THE SCALAR PRODUCT OF A VECTOR AND A COLUMN VECTOR BY DOUBLE PRECISION.
 LNGVEVEC CALCULATES THE SCALAR PRODUCT OF TWO VECTORS BY DOUBLE LENGTH ARITHMETIC.
 LOG GAMMA CALCULATES THE NATURAL LOGARITHM OF THE GAMMA FUNCTION FOR POSITIVE ARGUMENTS.
 LOGARITHM OF THE GAMMA FUNCTION FOR POSITIVE ARGUMENTS.
 LONG NONNEGATIVE INTEGER AND POWER IS THE POSITIVE (SINGLE-LENGTH) EXPONENT.
 LONG NONNEGATIVE INTEGERS.
 LONG NONNEGATIVE INTEGERS.
 LONG NONNEGATIVE INTEGERS.
 LONG NONNEGATIVE INTEGERS.
 LONG NONNEGATIVE INTEGERS.
 LSQDGLINV CALCULATES THE DIAGONAL ELEMENTS OF THE INVERSE OF M*M, WHERE M IS THE COEFFICIENT MATRIX OF A LINEAR LEAST SQUARES PROBLEM.
 LSQINV CALCULATES THE INVERSE OF THE MATRIX S'S, WHERE S IS THE COEFFICIENT MATRIX OF A LINEAR LEAST SQUARES PROBLEM.
 LSQRTDEC DELIVERS THE HOUSEHOLDER TRIANGULARIZATION WITH COLUMN INTERCHANGES OF THE MATRIX.
 LSQRTDECSOL SOLVES A LINEAR LEAST SQUARES PROBLEM BY HOUSEHOLDER TRIANGULARIZATION WITH COLUMN INTERCHANGES.
 LSQSOL SOLVES A LINEAR LEAST SQUARES PROBLEM IF THE COEFFICIENT MATRIX HAS BEEN DECOMPOSED BY HOUSEHOLDER TRIANGULARIZATION.
 LUPZERORPOL CALCULATES A NUMBER OF ADJACENT UPPER OR LOWER ZEROS OF AN ORTHOGONAL POLYNOMIAL.
 MARQUARDT CALCULATES THE LEAST SQUARES SOLUTION OF AN OVERDETERMINED SYSTEM OF NON-LINEAR EQUATIONS.
 MATMAT I = SCALAR PRODUCT OF A ROW VECTOR AND A COLUMN VECTOR.
 MATRIX INTO ANOTHER MATRIX.
 MATRIX WITH A COMPLEX HOUSEHOLDER MATRIX.
 MATRIX WITH A CONSTANT.
 MATRIX.
 MATRIX.
 MATMAT I = SCALAR PRODUCT OF A ROW VECTOR AND A ROW VECTOR.
 MATVEC I = SCALAR PRODUCT OF A ROW VECTOR AND A VECTOR.
 MAXELMROW ADDS A CONSTANT TIMES A ROW VECTOR TO A ROW VECTOR, MAXELMROW=THE SUBSCRIPT OF THE ROW VECTOR WHICH IS OF MAXIMUM ABSOLUTE VALUE.
 MAXELMROW=THE SUBSCRIPT OF AN ELEMENT OF THE NEW ROW VECTOR WHICH IS OF MAXIMUM ABSOLUTE VALUE.
 MBASE DELIVERS THE BASE OF THE ARITHMETIC OF THE COMPUTER.
 MINIMIZES A FUNCTION OF ONE VARIABLE IN A GIVEN INTERVAL.
 MINIMIZES A FUNCTION OF ONE VARIABLE IN A GIVEN INTERVAL, USING VALUES OF THE FUNCTION AND ITS DERIVATIVE.
 MINIMIZES A FUNCTION OF SEVERAL VARIABLES IN A GIVEN DIRECTION.
 MINIMIZES A FUNCTION OF SEVERAL VARIABLES.
 MINIMIZES A FUNCTION OF SEVERAL VARIABLES.
 MINIMIZES A FUNCTION OF SEVERAL VARIABLES.
 MININ MINIMIZES A FUNCTION OF ONE VARIABLE IN A GIVEN INTERVAL.
 MININDER MINIMIZES A FUNCTION OF ONE VARIABLE IN A GIVEN INTERVAL, USING VALUES OF THE FUNCTION AND ITS DERIVATIVE.
 MINMAXPOL CALCULATES THE COEFFICIENTS OF THE POLYNOMIAL THAT APPROXIMATES A FUNCTION, GIVES THE MAXIMUM ERROR.
 MODIFIED BESSEL FUNCTION OF THE 1ST KIND OF ORDER ONE.
 MODIFIED BESSEL FUNCTION OF THE 1ST KIND OF ORDER ONE; THE RESULT IS MULTIPLIED BY EXP(-ABS(X)).
 MODIFIED BESSEL FUNCTION OF THE 1ST KIND OF ORDER ZERO.
 MODIFIED BESSEL FUNCTION OF THE 1ST KIND OF ORDER ZERO; THE RESULT IS MULTIPLIED BY EXP(-ABS(X)).
 MODIFIED BESSEL FUNCTIONS OF THE 1ST KIND OF ORDER A+N, N=0,...,NMAX, A>=0 AND ARGUMENT X.
 MODIFIED BESSEL FUNCTIONS OF THE 1ST KIND OF ORDER A+N, N=0,...,NMAX, A>=0 AND ARGUMENT X.
 MODIFIED BESSEL FUNCTIONS OF THE 1ST KIND OF ORDER L (L = 0,...,N).
 MODIFIED BESSEL FUNCTIONS OF THE 1ST KIND OF ORDER L (L = 0,...,N); THE RESULT IS MULTIPLIED BY EXP(-ABS(X)).
 MODIFIED BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER A AND A+1, A>=0 AND ARGUMENT X, X>0, MU=1.
 MODIFIED BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER A AND A+1, A>=0, AND ARGUMENT X, X>0.
 MODIFIED BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER A+N, N=0,...,NMAX, A>=0 AND ARGUMENT X.
 MODIFIED BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER A+N, N=0,...,NMAX, A>=0, AND ARGUMENT X.
 MODIFIED BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER L (L = 0,...,N) WITH ARGUMENT X, X > 0.
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 MODIFIED BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER ZERO AND ONE WITH ARGUMENT X, X>0; THE RESULT IS MULTIPLIED BY EXP(-X).
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31090 203 SINER EVALUATES A SINE SERIES.
31091 203 COSER EVALUATES A COSINE SERIES.
31092 203 FOUER EVALUATES A FOURIER SERIES WITH EQUAL SINE AND COSINE COEFFICIENTS.
31093 203 FOUER1 EVALUATES A FOURIER SERIES.
31094 203 FOUER2 EVALUATES A FOURIER SERIES.
31095 203 COMFOUER EVALUATES A COMPLEX FOURIER SERIES WITH REAL COEFFICIENTS.

- 31096 203 COMFOUSER1 EVALUATES A COMPLEX FOURIER SERIES.
31097 203 COMFOUSER2 EVALUATES A COMPLEX FOURIER SERIES.
31101 271 DPADD ADDS TWO SINGLE PRECISION NUMBERS TO A DOUBLE PRECISION SUM.
31102 271 DPSSUB SUBTRACTS TWO SINGLE PRECISION NUMBERS TO A DOUBLE PRECISION DIFFERENCE.
31103 271 DPMUL MULTIPLIES TWO SINGLE PRECISION NUMBERS TO A DOUBLE PRECISION PRODUCT.
31104 271 DPDIV DIVIDES TWO SINGLE PRECISION NUMBERS TO A DOUBLE PRECISION QUOTIENT.
31105 271 LNGADD ADDS TWO DOUBLE PRECISION NUMBERS.
31106 271 LNGSUB SUBTRACTS TWO DOUBLE PRECISION NUMBERS.
31107 271 LNGMUL MULTIPLIES TWO DOUBLE PRECISION NUMBERS.
31108 271 LNGDIV DIVIDES TWO DOUBLE PRECISION NUMBERS.
31131 5 COLCST MULTIPLIES A COLUMN VECTOR BY A CONSTANT.
31132 5 ROWCST MULTIPLIES A ROW VECTOR BY A CONSTANT.
31200 201 LNGINTADD COMPUTES THE SUM OF LONG NONNEGATIVE INTEGERS.
31201 201 LNGINTSUBTRACT COMPUTES THE DIFFERENCE OF LONG NONNEGATIVE INTEGERS.
31202 201 LNGINTMULT COMPUTES THE PRODUCT OF LONG NONNEGATIVE INTEGERS.
31203 201 LNGINTDIVIDE COMPUTES THE QUOTIENT WITH REMAINDER OF LONG NONNEGATIVE INTEGERS.
31204 201 LNGINTPOWER COMPUTES $U^{**POWER}$, WHERE U IS A LONG NONNEGATIVE INTEGER AND POWER IS THE POSITIVE (SINGLE-LENGTH) EXPONENT.
31241 245 TAYPOL EVALUATES THE FIRST K TERMS OF A TAYLOR SERIES.
31242 245 NORDERPOL EVALUATES THE FIRST K NORMALIZED DERIVATIVES OF A POLYNOMIAL (I.E. J-TH DERIVATIVE/(J FACTORIAL)), $J=0,1,\dots,K \leftarrow$ DEGREE.
31243 245 DERPOL EVALUATES THE FIRST K DERIVATIVES OF A POLYNOMIAL.
31248 205 INTGHS COMPUTES THE INDEFINITE INTEGRAL OF A GIVEN CHEBYSHEV SERIES.
31302 211 ALLZERORTPOL CALCULATES ALL ZEROS OF AN ORTHOGONAL POLYNOMIAL.
31303 211 LUFZERORTPOL CALCULATES A NUMBER OF ADJACENT UPPER OR LOWER ZEROS OF AN ORTHOGONAL POLYNOMIAL.
31304 211 SELZERORTPOL CALCULATES A NUMBER OF ADJACENT ZEROS OF AN ORTHOGONAL POLYNOMIAL.
31500 15 FULMATVEC CALCULATES THE PRODUCT $A * B$, WHERE A IS A GIVEN MATRIX AND B IS A VECTOR.
31501 15 FULTAMVEC CALCULATES THE PRODUCT $A' * B$, WHERE A' IS THE TRANSPOSED OF THE MATRIX A AND B IS A VECTOR.
31502 15 FULSYMMATVEC CALCULATES THE PRODUCT $A * B$, WHERE A IS A SYMMETRIC MATRIX, WHOSE UPPERTRIANGLE IS STORED COLUMNWISE IN A ONE-DIMENSIONAL ARRAY AND B IS A VECTOR.
31503 15 RESVEC CALCULATES THE RESIDUAL VECTOR $A * B + X * C$, WHERE A IS A GIVEN MATRIX, B AND C ARE VECTORS AND X IS A SCALAR.
31504 15 SYMRESVEC CALCULATES THE RESIDUAL VECTOR $A * B + X * C$, WHERE A IS A SYMMETRIC MATRIX, WHOSE UPPERTRIANGLE IS STORED COLUMNWISE IN A ONE-DIMENSIONAL ARRAY, B AND C ARE VECTORS AND X IS A SCALAR.
31505 285 LNGFULMATVEC CALCULATES BY DOUBLE PRECISION ARITHMETIC THE PRODUCT $A * B$, WHERE A IS A GIVEN MATRIX AND B IS A VECTOR.
31506 285 LNGFULTAMVEC CALCULATES BY DOUBLE PRECISION ARITHMETIC THE PRODUCT $A' * B$, WHERE A' IS THE TRANSPOSED OF THE MATRIX A AND B IS A VECTOR.
31507 285 LNGFULSYMMATVEC CALCULATES BY DOUBLE PRECISION ARITHMETIC THE PRODUCT $A * B$, WHERE A IS A SYMMETRIC MATRIX, WHOSE UPPERTRIANGLE IS STORED COLUMNWISE IN A ONE-DIMENSIONAL ARRAY AND B IS A VECTOR.
31508 285 LNGRESVEC CALCULATES BY DOUBLE PRECISION ARITHMETIC THE RESIDUAL VECTOR $A * B + X * C$, WHERE A IS A GIVEN MATRIX, B AND C ARE VECTORS AND X IS A SCALAR.
31509 285 LNGSYMRESVEC CALCULATES BY DOUBLE PRECISION ARITHMETIC THE RESIDUAL VECTOR $A * B + X * C$, WHERE A IS A SYMMETRIC MATRIX, WHOSE UPPERTRIANGLE IS STORED COLUMNWISE IN A ONE-DIMENSIONAL ARRAY, B AND C ARE VECTORS AND X IS A SCALAR.
32010 131 EULER PERFORMS THE SUMMATION OF AN ALTERNATING INFINITE SERIES.
32020 131 SUMPOSSERIES PERFORMS THE SUMMATION OF A INFINITE SERIES WITH POSITIVE MONOTONICALLY DECREASING TERMS USING THE VAN WIJNGAARDEN TRANSFORMATION.
32051 135 INTEGRAL CALCULATES THE DEFINITE INTEGRAL OF A FUNCTION OF ONE VARIABLE OVER A FINITE OR INFINITE INTERVAL OR OVER A NUMBER OF CONSECUTIVE INTERVALS.
32070 133 QADRAT COMPUTES THE DEFINITE INTEGRAL OF A FUNCTION OF ONE VARIABLE OVER A FINITE INTERVAL.
32075 257 TRICUB COMPUTES THE DEFINITE INTEGRAL OF A FUNCTION OF TWO VARIABLES OVER A TRIANGULAR DOMAIN.
33010 141 RK1 SOLVES A SINGLE 1ST ORDER DIFFERENTIAL EQUATION BY MEANS OF A 5TH ORDER RUNGE-KUTTA METHOD.
33012 171 RK2 INTEGRATES A SINGLE 2ND ORDER DIFFERENTIAL EQUATION (INITIAL VALUE PROBLEM) BY MEANS OF A 5TH ORDER RUNGE-KUTTA METHOD.
33013 173 RK2N SOLVES A SYSTEM OF 2ND ORDER DIFFERENTIAL EQUATIONS (INITIAL VALUE PROBLEM) BY MEANS OF A 5TH ORDER RUNGE-KUTTA METHOD.
33014 175 RK3 SOLVES A SINGLE 2ND ORDER DIFFERENTIAL EQUATION (INITIAL VALUE PROBLEM) BY MEANS OF A 5TH ORDER RUNGE-KUTTA METHOD; THIS METHOD CAN ONLY BE USED IF THE RIGHT HAND SIDE OF THE DIFFERENTIAL EQUATION DOES NOT DEPEND ON Y' .
33015 177 RK3N SOLVES A SYSTEM OF 2ND ORDER DIFFERENTIAL EQUATIONS (INITIAL VALUE PROBLEM) BY MEANS OF A 5TH ORDER RUNGE-KUTTA METHOD; THIS METHOD CAN ONLY BE USED IF THE RIGHT HAND SIDE OF THE DIFFERENTIAL EQUATIONS DOES NOT DEPEND ON Y' .

- 33016 145 RK4A SOLVES A SINGLE 1ST ORDER DIFFERENTIAL EQUATION BY MEANS OF A 5TH ORDER RUNGE-KUTTA METHOD; THE INTEGRATION IS TERMINATED AS SOON AS A CONDITION ON X AND Y, WHICH IS SUPPLIED BY THE USER, IS SATISFIED.
- 33017 147 RK4NA SOLVES A SYSTEM OF 1ST ORDER DIFFERENTIAL EQUATIONS (INITIAL VALUE PROBLEM) BY MEANS OF A 5TH ORDER RUNGE-KUTTA METHOD; THE INTEGRATION IS TERMINATED AS SOON AS A CONDITION ON X(0),...,X(N) , SUPPLIED BY THE USER, IS SATISFIED.
- 33018 149 RK5NA SOLVES A SYSTEM OF 1ST ORDER DIFFERENTIAL EQUATIONS (INITIAL VALUE PROBLEM) BY MEANS OF A 5TH ORDER RUNGE-KUTTA METHOD; THE ARC LENGTH IS INTRODUCED AS AN INTEGRATION VARIABLE; THE INTEGRATION IS TERMINATED AS SOON AS A CONDITION ON X(0),...,X(N) , SUPPLIED BY THE USER, IS SATISFIED.
- 33033 143 RKE SOLVES A SYSTEM OF 1ST ORDER DIFFERENTIAL EQUATIONS (INITIAL VALUE PROBLEM) BY MEANS OF A 5TH ORDER RUNGE-KUTTA METHOD.
- 33040 167 MODIFIED TAYLOR SOLVES A SYSTEM OF 1ST ORDER DIFFERENTIAL EQUATIONS (INITIAL VALUE PROBLEM) BY MEANS OF A 1ST, 2ND OR 3RD ORDER ONE-STEP TAYLOR METHOD; THIS METHOD CAN BE USED TO SOLVE LARGE AND SPARSE SYSTEMS, PROVIDED HIGHER ORDER DERIVATIVES CAN EASILY BE OBTAINED.
- 33050 169 EXPONENTIALLY FITTED TAYLOR SOLVES A SYSTEM OF 1ST ORDER DIFFERENTIAL EQUATIONS (INITIAL VALUE PROBLEM) BY MEANS OF A VARIABLE ORDER TAYLOR METHOD; THIS METHOD CAN BE USED TO SOLVE STIFF SYSTEMS, WITH KNOWN EIGEN VALUE SPECTRUM, PROVIDED HIGHER ORDER DERIVATIVES CAN EASILY BE OBTAINED.
- 33061 155 ARK SOLVES A SYSTEM OF 1ST ORDER DIFFERENTIAL EQUATIONS (INITIAL VALUE PROBLEM) BY MEANS OF A STABILIZED RUNGE-KUTTA METHOD WITH LIMITED STORAGE REQUIREMENTS.
- 33070 157 EFRK SOLVES A SYSTEM OF 1ST ORDER DIFFERENTIAL EQUATIONS (INITIAL VALUE PROBLEM) BY MEANS OF A 1ST, 2ND OR 3RD ORDER, EXPONENTIALLY FITTED RUNGE-KUTTA METHOD; AUTOMATIC STEPSIZE CONTROL IS NOT PROVIDED; THIS METHOD CAN BE USED TO SOLVE STIFF SYSTEMS WITH KNOWN EIGENVALUE SPECTRUM.
- 33080 151 MULTISTEP SOLVES A SYSTEM OF 1ST ORDER DIFFERENTIAL EQUATIONS (INITIAL VALUE PROBLEM) BY MEANS OF A VARIABLE ORDER MULTISTEP METHOD ADAMS-MOULTON, ADAMS-BASHFORTH OR GEAR'S METHOD; THE ORDER OF ACCURACY IS AUTOMATIC, UP TO 5TH ORDER; THIS METHOD IS SUITABLE FOR STIFF SYSTEMS.
- 33120 161 EFERK SOLVES AN AUTONOMOUS SYSTEM OF 1ST ORDER DIFFERENTIAL EQUATIONS (INITIAL VALUE PROBLEM) BY MEANS OF AN EXPONENTIALLY FITTED, 3RD ORDER RUNGE-KUTTA METHOD; THIS METHOD CAN BE USED TO SOLVE STIFF SYSTEMS WITH KNOWN EIGENVALUE SPECTRUM.
- 33131 165 LINIGER2 SOLVES AN AUTONOMOUS SYSTEM OF 1ST ORDER DIFFERENTIAL EQUATIONS (INITIAL VALUE PROBLEM) BY MEANS OF AN IMPLICIT, EXPONENTIALLY FITTED 1ST ORDER ONE-STEP METHOD; AUTOMATIC STEP-SIZE CONTROL IS NOT PROVIDED; THIS METHOD CAN BE USED TO SOLVE STIFF SYSTEMS.
- 33132 221 LINIGER1VS SOLVES AN AUTONOMOUS SYSTEM OF 1ST ORDER DIFFERENTIAL EQUATIONS (INITIAL VALUE PROBLEM) BY MEANS OF AN IMPLICIT, EXPONENTIALLY FITTED 1ST ORDER ONE-STEP METHOD; THIS METHOD CAN BE USED TO SOLVE STIFF SYSTEMS.
- 33135 231 IMPEX SOLVES AN AUTONOMOUS SYSTEM OF 1ST ORDER DIFFERENTIAL EQUATIONS (INITIAL VALUE PROBLEM) BY MEANS OF THE IMPLICIT MIDPOINT RULE WITH SMOOTHING AND EXTRAPOLATION; THIS METHOD IS SUITABLE FOR THE INTEGRATION OF STIFF DIFFERENTIAL EQUATIONS.
- 33160 159 EFSIRK SOLVES AN AUTONOMOUS SYSTEM OF 1ST ORDER DIFFERENTIAL EQUATIONS (INITIAL VALUE PROBLEM) BY MEANS OF A 3RD ORDER, EXPONENTIALLY FITTED, SEMI-IMPLICIT RUNGE-KUTTA METHOD; THIS METHOD CAN BE USED TO SOLVE STIFF SYSTEMS.
- 33170 225 RICHARDSON SOLVES A SYSTEM OF LINEAR EQUATIONS WITH POSITIVE REAL EIGENVALUES (ELLIPTIC BOUNDARY VALUE PROBLEM) BY MEANS OF A NON-STATIONARY 2ND ORDER ITERATIVE METHOD.
- 33171 225 ELIMINATION SOLVES A SYSTEM OF LINEAR EQUATIONS WITH POSITIVE REAL EIGENVALUES (ELLIPTIC BOUNDARY VALUE PROBLEM) BY MEANS OF A NON-STATIONARY 2ND ORDER ITERATIVE METHOD, WHICH IS AN ACCELERATION OF RICHARDSON'S METHOD.
- 33180 153 DIFFSYS SOLVES A SYSTEM OF 1ST ORDER DIFFERENTIAL EQUATIONS (INITIAL VALUE PROBLEM); BY EXTRAPOLATION, APPLIED TO LOW ORDER RESULTS, A HIGH ORDER OF ACCURACY IS OBTAINED; THIS METHOD IS SUITABLE FOR SMOOTH PROBLEMS WHEN HIGH ACCURACY IS REQUIRED.
- 33191 223 GMS SOLVES AN AUTONOMOUS SYSTEM OF 1ST ORDER DIFFERENTIAL EQUATIONS (INITIAL VALUE PROBLEM) BY MEANS OF A 3RD ORDER MULTISTEP METHOD; THIS METHOD CAN BE USED TO SOLVE STIFF SYSTEMS.
- 33300 261 FEMLAG SOLVES A LINEAR TWO-POINT BOUNDARY-VALUE PROBLEM FOR A SECOND ORDER SELF-ADJOINT DIFFERENTIAL EQUATION BY A RITZ-GALERKIN METHOD; THE COEFFICIENT OF Y'' IS SUPPOSED TO BE UNITY.
- 33301 261 FEMLAGSYM SOLVES A LINEAR TWO-POINT BOUNDARY-VALUE PROBLEM FOR A SECOND ORDER SELF-ADJOINT DIFFERENTIAL EQUATION BY A RITZ-GALERKIN METHOD.
- 33302 263 FEMLAGSKEW SOLVES A LINEAR TWO-POINT BOUNDARY-VALUE PROBLEM FOR A SECOND ORDER DIFFERENTIAL EQUATION BY A RITZ-GALERKIN METHOD.
- 33303 265 FEMHERMSYM SOLVES A LINEAR TWO-POINT BOUNDARY-VALUE PROBLEM FOR A FOURTH ORDER SELF-ADJOINT DIFFERENTIAL EQUATION WITH DIRICHLET BOUNDARY CONDITIONS BY A RITZ-GALERKIN METHOD.
- 34010 7 VECVEC := SCALAR PRODUCT OF A VECTOR AND A VECTOR.
- 34011 7 MATVEC := SCALAR PRODUCT OF A ROW VECTOR AND A VECTOR.
- 34012 7 TAMVEC := SCALAR PRODUCT OF A COLUMN VECTOR AND A VECTOR.
- 34013 7 MATMAT := SCALAR PRODUCT OF A ROW VECTOR AND A COLUMN VECTOR.
- 34014 7 TAMMAT := SCALAR PRODUCT OF A COLUMN VECTOR AND A COLUMN VECTOR.
- 34015 7 MATTAT := SCALAR PRODUCT OF A ROW VECTOR AND A ROW VECTOR.
- 34016 7 SEQVEC := SCALAR PRODUCT OF TWO VECTORS GIVEN IN ONE-DIMENSIONAL ARRAYS, WHERE THE MUTUAL SPACINGS BETWEEN THE INDICES OF THE

- 1ST VECTOR CHANGE LINEARLY.
- 34017 7 SCAPRD1 := SCALAR PRODUCT OF TWO VECTORS GIVEN IN ONE-DIMENSIONAL ARRAYS, WHERE THE SPACINGS OF BOTH VECTORS ARE CONSTANT.
- 34018 7 SYMMATVEC := SCALAR PRODUCT OF A VECTOR AND A ROW OF A SYMMETRIC MATRIX, WHOSE UPPERTRIANGLE IS GIVEN COLUMNWISE IN A ONE-DIMENSIONAL ARRAY.
- 34020 9 ELMVEC ADDS A CONSTANT TIMES A VECTOR TO A VECTOR.
- 34021 9 ELMVECCOL ADDS A CONSTANT TIMES A COLUMN VECTOR TO A VECTOR.
- 34022 9 ELMCOLVEC ADDS A CONSTANT TIMES A VECTOR TO A COLUMN VECTOR.
- 34023 9 ELMCOL ADDS A CONSTANT TIMES A COLUMN VECTOR TO A COLUMN VECTOR.
- 34024 9 ELMROW ADDS A CONSTANT TIMES A ROW VECTOR TO A ROW VECTOR.
- 34025 9 MAXELMROW ADDS A CONSTANT TIMES A ROW VECTOR TO A ROW VECTOR, MAXELMROW:=THE SUBSCRIPT OF AN ELEMENT OF THE NEW ROW VECTOR WHICH IS OF MAXIMUM ABSOLUTE VALUE.
- 34026 9 ELMVEGROW ADDS A CONSTANT TIMES A ROW VECTOR TO A VECTOR.
- 34027 9 ELMROWVEC ADDS A CONSTANT TIMES A VECTOR TO A ROW VECTOR.
- 34028 9 ELMROWCOL ADDS A CONSTANT TIMES A COLUMN VECTOR TO A ROW VECTOR.
- 34029 9 ELMCOLROW ADDS A CONSTANT TIMES A ROW VECTOR TO A COLUMN VECTOR.
- 34030 11 ICHVEC INTERCHANGES TWO VECTORS GIVEN IN ARRAY A(I:U) AND ARRAY A(SHIFT + L : SHIFT + U).
- 34031 11 ICHCOL INTERCHANGES TWO COLUMNS OF A MATRIX.
- 34032 11 ICHROW INTERCHANGES TWO ROWS OF MATRIX.
- 34033 11 ICHROWCOL INTERCHANGES A ROW AND A COLUMN OF A MATRIX.
- 34034 11 ICHSEQVEC INTERCHANGES A ROW AND A COLUMN OF AN UPPERTRIANGULAR MATRIX, WHICH IS STORED COLUMNWISE IN A ONE-DIMENSIONAL ARRAY.
- 34035 11 ICHSEQ INTERCHANGES TWO COLUMNS OF AN UPPERTRIANGULAR MATRIX, WHICH IS STORED COLUMNWISE IN A ONE-DIMENSIONAL ARRAY.
- 34040 13 ROTCOL REPLACES TWO COLUMN VECTORS X AND Y BY TWO VECTORS CX + SY AND CY - SX.
- 34041 13 ROTROW REPLACES TWO ROW VECTORS X AND Y BY TWO VECTORS CX + SY AND CY - SX.
- 34051 49 SOL SOLVES THE SYSTEM OF LINEAR EQUATIONS WHOSE MATRIX HAS BEEN TRIANGULARLY DECOMPOSED BY DEC.
- 34053 51 INV CALCULATES THE INVERSE OF A MATRIX THAT HAS BEEN TRIANGULARLY DECOMPOSED BY DEC.
- 34061 49 SOLELM SOLVES A SYSTEM OF LINEAR EQUATIONS WHOSE MATRIX HAS BEEN TRIANGULARLY DECOMPOSED BY GSSELN OR GSSERB.
- 34071 79 SOLBND SOLVES A SYSTEM OF LINEAR EQUATIONS, THE MATRIX BEING DECOMPOSED BY DECBND.
- 34131 65 LSQSOL SOLVES A LINEAR LEAST SQUARES PROBLEM IF THE COEFFICIENT MATRIX HAS BEEN DECOMPOSED BY LSQRTDEC.
- 34132 63 LSQDGLNV CALCULATES THE DIAGONAL ELEMENTS OF THE INVERSE OF M*M, WHERE M IS THE COEFFICIENT MATRIX OF A LINEAR LEAST SQUARES PROBLEM.
- 34134 63 LSQRTDEC DELIVERS THE HOUSEHOLDER TRIANGULARIZATION WITH COLUMN INTERCHANGES OF THE MATRIX OF A LINEAR LEAST SQUARES PROBLEM.
- 34135 65 LSQRTDECSOL SOLVES A LINEAR LEAST SQUARES PROBLEM BY HOUSEHOLDER TRIANGULARIZATION WITH COLUMN INTERCHANGES AND CALCULATES THE DIAGONAL OF THE INVERSE OF M*M, WHERE M IS THE COEFFICIENT MATRIX.
- 34136 207 LSQINV CALCULATES THE INVERSE OF THE MATRIX S'S, WHERE S IS THE COEFFICIENT MATRIX OF A LINEAR LEAST SQUARES PROBLEM.
- 34140 101 TFMSYMRI2 TRANSFORMS A REAL SYMMETRIC MATRIX INTO A SIMILAR TRIDIAGONAL ONE BY MEANS OF HOUSEHOLDER'S TRANSFORMATION.
- 34141 101 BAKSYMRI2 PERFORMS THE BACK TRANSFORMATION CORRESPONDING TO TFMSYMRI2.
- 34142 101 TFMPREVEC IN COMBINATION WITH TFMSYMRI2 CALCULATES THE TRANSFORMING MATRIX.
- 34143 101 TFMSYMRI1 TRANSFORMS A REAL SYMMETRIC MATRIX INTO A SIMILAR TRIDIAGONAL ONE BY MEANS OF HOUSEHOLDER'S TRANSFORMATION.
- 34144 101 BAKSYMRI1 PERFORMS THE BACK TRANSFORMATION CORRESPONDING TO TFMSYMRI1.
- 34150 215 ZEROIN FINDS (IN A GIVEN INTERVAL) A ZERO OF A FUNCTION OF ONE VARIABLE.
- 34151 111 VALSYMRI CALCULATES ALL, OR SOME CONSECUTIVE, EIGENVALUES OF A SYMMETRIC TRIDIAGONAL MATRIX BY MEANS OF LINEAR INTERPOLATION USING A STURM SEQUENCE.
- 34152 111 VECSYMRI CALCULATES EIGENVECTORS OF A SYMMETRIC TRIDIAGONAL MATRIX BY MEANS OF INVERSE ITERATION.
- 34153 113 EIGVALSYM2 CALCULATES ALL (OR SOME) EIGENVALUES OF A SYMMETRIC MATRIX USING LINEAR INTERPOLATION OF A FUNCTION DERIVED FROM A STURM SEQUENCE.
- 34154 113 EIGSYM2 CALCULATES EIGENVALUES AND EIGENVECTORS BY MEANS OF INVERSE ITERATION.
- 34155 113 EIGVALSYM1 CALCULATES ALL (OR SOME) EIGENVALUES OF A SYMMETRIC MATRIX USING LINEAR INTERPOLATION OF A FUNCTION DERIVED FROM A STURM SEQUENCE.
- 34156 113 EIGSYM1 CALCULATES EIGENVALUES AND EIGENVECTORS BY MEANS OF INVERSE ITERATION.
- 34160 111 QRIVALSYMTRI CALCULATES THE EIGENVALUES OF A SYMMETRIC TRIDIAGONAL MATRIX BY MEANS OF QR ITERATION.
- 34161 111 QRISYMRI CALCULATES THE EIGENVALUES AND EIGENVECTORS OF A SYMMETRIC TRIDIAGONAL MATRIX BY MEANS OF QR ITERATION.
- 34162 113 QRIVALSYM2 CALCULATES THE EIGENVALUES OF A SYMMETRIC MATRIX BY MEANS OF QR ITERATION.
- 34163 113 QRISYM CALCULATES ALL EIGENVALUES AND EIGENVECTORS OF A SYMMETRIC MATRIX BY MEANS OF QR ITERATION.
- 34164 113 QRIVALSYM1 CALCULATES THE EIGENVALUES OF A SYMMETRIC MATRIX BY MEANS OF QR ITERATION.

- 34170 103 TFMREAHES TRANSFORMS A MATRIX INTO A SIMILAR UPPER-HESSSENBERG MATRIX BY MEANS OF WILKINSON'S TRANSFORMATION.
34171 103 BAKREAHES1 PERFORMS THE BACK TRANSFORMATION (ON A VECTOR) CORRESPONDING TO TFMREAHES.
34172 103 BAKREAHES2 PERFORMS THE BACK TRANSFORMATION (ON COLUMNS) CORRESPONDING TO TFMREAHES.
34173 97 EQUILBK EQUILIBRATES A MATRIX BY MEANS OF A DIAGONAL SIMILARITY TRANSFORMATION.
34174 97 BAKLBR PERFORMS THE BACK TRANSFORMATION CORRESPONDING TO EQUILBR.
34180 115 KEAVALQRI CALCULATES THE EIGENVALUES OF A REAL UPPER-HESSSENBERG MATRIX, PROVIDED THAT ALL EIGENVALUES ARE REAL, BY MEANS OF SINGLE QR ITERATION.
34181 115 KEAVECHES CALCULATES AN EIGENVECTOR CORRESPONDING TO A GIVEN REAL EIGENVALUE OF A REAL UPPER-HESSSENBERG MATRIX BY MEANS OF INVERSE ITERATION.
34182 117 REAEIGVAL CALCULATES THE EIGENVALUES OF A MATRIX, PROVIDED THAT ALL EIGENVALUES ARE REAL.
34183 17 REASGL NORMALIZES THE COLUMNS OF A TWO-DIMENSIONAL ARRAY.
34184 117 REAEIG1 CALCULATES THE EIGENVECTORS AND EIGENVALUES OF A MATRIX, PROVIDED THAT THEY ARE ALL REAL.
34186 115 KEAQR1 CALCULATES ALL EIGENVALUES AND EIGENVECTORS OF A REAL UPPER-HESSSENBERG MATRIX, PROVIDED THAT ALL EIGENVALUES ARE REAL, BY MEANS OF SINGLE QR ITERATION.
34187 117 REAEIG3 CALCULATES THE EIGENVECTORS AND EIGENVALUES OF A MATRIX, PROVIDED THAT THEY ARE ALL REAL.
34190 115 COMVALQRI CALCULATES THE REAL AND COMPLEX EIGENVALUES OF A REAL UPPER-HESSSENBERG MATRIX BY MEANS OF DOUBLE QR ITERATION.
34191 115 COMVECHES CALCULATES THE EIGENVECTOR CORRESPONDING TO A GIVEN COMPLEX EIGENVALUE OF A REAL UPPER-HESSSENBERG MATRIX BY MEANS OF INVERSE ITERATION.
34192 117 COMEIGVAL CALCULATES THE EIGENVALUES OF A MATRIX.
34193 29 COMSGL NORMALIZES REAL AND COMPLEX EIGENVECTORS.
34194 117 COMEIG1 CALCULATES THE EIGENVALUES AND EIGENVECTORS OF A MATRIX.
34210 139 LINEMIN MINIMIZES A FUNCTION OF SEVERAL VARIABLES IN A GIVEN DIRECTION.
34211 139 KNKIUPD ADDS A RANK-1 MATRIX TO A SYMMETRIC MATRIX.
34212 139 DAVUPD ADDS A RANK-2 MATRIX TO A SYMMETRIC MATRIX.
34213 139 FLEUPD ADDS A RANK-2 MATRIX TO A SYMMETRIC MATRIX.
34214 19 RNKIMIN MINIMIZES A FUNCTION OF SEVERAL VARIABLES.
34215 19 FLEMIN MINIMIZES A FUNCTION OF SEVERAL VARIABLES.
34220 95 CONJ GRAD SOLVES A POSITIVE DEFINITE SYMMETRIC SYSTEM OF LINEAR EQUATIONS BY THE METHOD OF CONJUGATE GRADIENTS.
34231 45 GSSELM PERFORMS A TRIANGULAR DECOMPOSITION WITH A COMBINATION OF PARTIAL AND COMPLETE PIVOTING.
34232 49 GSSOL SOLVES A SYSTEM OF LINEAR EQUATIONS.
34235 51 INVI CALCULATES THE INVERSE OF A MATRIX THAT HAS BEEN TRIANGULARLY DECOMPOSED BY GSSELM OR GSSERB. THE 1-NORM OF THE INVERSE MATRIX MIGHT ALSO BE CALCULATED.
34236 51 GSSINV CALCULATES THE INVERSE OF A MATRIX.
34240 45 ONENKMINV CALCULATES THE 1-NORM OF THE INVERSE OF A MATRIX WHOSE TRIANGULARLY DECOMPOSED FORM IS DELIVERED BY GSSELM.
34241 45 ERBELM CALCULATES A ROUGH UPPERBOUND FOR THE ERROR IN THE SOLUTION OF A SYSTEM OF LINEAR EQUATIONS WHOSE MATRIX IS TRIANGULARLY DECOMPOSED BY GSSELM.
34242 45 GSSERB PERFORMS A TRIANGULAR DECOMPOSITION OF THE MATRIX OF A SYSTEM OF LINEAR EQUATIONS AND CALCULATES AN UPPERBOUND FOR THE RELATIVE ERROR IN THE SOLUTION OF THAT SYSTEM.
34243 49 GSSOLERB SOLVES A SYSTEM OF LINEAR EQUATIONS AND CALCULATES A ROUGH UPPERBOUND FOR THE RELATIVE ERROR IN THE CALCULATED SOLUTION.
34244 51 GSSINVERB CALCULATES THE INVERSE OF A MATRIX AND 1-NORM, AN UPPERBOUND FOR THE ERROR IN THE INVERSE MATRIX IS ALSO GIVEN.
34250 53 ITISOL SOLVES A SYSTEM OF LINEAR EQUATIONS WHOSE MATRIX HAS BEEN TRIANGULARLY DECOMPOSED BY GSSELM OR GSSERB. THIS SOLUTION IS IMPROVED ITERATIVELY.
34251 53 GSSITISOL SOLVES A SYSTEM OF LINEAR EQUATIONS AND THE SOLUTION IS IMPROVED ITERATIVELY.
34252 45 GSSNRI PERFORMS A TRIANGULAR DECOMPOSITION AND CALCULATES THE 1-NORM OF THE INVERSE MATRIX.
34253 53 ITISOLERB SOLVES A SYSTEM OF LINEAR EQUATIONS WHOSE MATRIX HAS TRIANGULARLY DECOMPOSED BY GSSNRI; THIS SOLUTION IS IMPROVED ITERATIVELY AN UPPERBOUND FOR THE ERROR IN THE SOLUTION IS CALCULATED.
34254 53 GSSITISOLERB SOLVES A SYSTEM OF LINEAR EQUATIONS; THIS SOLUTION IS IMPROVED ITERATIVELY AND AN UPPERBOUND FOR THE ERROR IN THE SOLUTION IS CALCULATED.
34260 109 HSHREABID TRANSFORMS A MATRIX TO BIDIAGONAL FORM, BY PREMULTIPLYING AND POSTMULTIPLYING WITH ORTHOGONAL MATRICES.
34261 109 PSTFMAT CALCULATES THE POSTMULTIPLYING MATRIX FROM THE DATA GENERATED BY HSHREABID.
34262 109 PRETFMAT CALCULATES THE PREMULTIPLYING MATRIX FROM THE DATA GENERATED BY HSHREABID.
34270 125 QRISNGVAL3ID CALCULATES THE SINGULAR VALUES OF A BIDIAGONAL MATRIX.
34271 125 QRISNGVALDEC3ID CALCULATES THE SINGULAR VALUES DECOMPOSITION OF A MATRIX OF WHICH THE BIDIAGONAL AND THE PRE- AND POSTMULTIPLYING MATRICES ARE GIVEN.
34272 127 QRISNGVAL CALCULATES THE SINGULAR VALUES OF A GIVEN MATRIX.

- 34273 127 QRISNGVALDEC CALCULATES THE SINGULAR VALUES DECOMPOSITION $U * S * V'$, WITH U AND V ORTHOGONAL AND S POSITIVE DIAGONAL.
- 34280 67 SOLSVDOVR SOLVES AN OVERDETERMINED SYSTEM OF LINEAR EQUATIONS, MULTIPLYING THE RIGHT-HAND SIDE BY THE PSEUDO-INVERSE OF THE GIVEN MATRIX.
- 34281 67 SOLOVR CALCULATES THE SINGULAR VALUES DECOMPOSITION AND SOLVES AN OVERDETERMINED SYSTEM OF LINEAR EQUATIONS.
- 34282 69 SOLSVDOUD SOLVES AN UNDERDETERMINED SYSTEM OF LINEAR EQUATIONS, MULTIPLYING THE RIGHT-HAND SIDE BY THE PSEUDO-INVERSE OF THE GIVEN MATRIX.
- 34283 69 SOLUND CALCULATES THE SINGULAR VALUES DECOMPOSITION AND SOLVES AN UNDERDETERMINED SYSTEM OF LINEAR EQUATIONS.
- 34284 71 HOMSOLSVD SOLVES THE HOMOGENEOUS SYSTEM OF LINEAR EQUATIONS $A * X = 0$ AND $X' * A = 0$, WHERE "A" DENOTES A MATRIX AND "X" A VECTOR; (THE SINGULAR VALUE DECOMPOSITION BEING GIVEN).
- 34285 71 HOMSOL SOLVES THE HOMOGENEOUS SYSTEM OF LINEAR EQUATIONS OF EQUATIONS $A * X = 0$ AND $X' * A = 0$, WHERE "A" DENOTES A MATRIX AND "X" A VECTOR.
- 34286 73 PSDINVSVD CALCULATES THE PSEUDO-INVERSE OF A MATRIX; (THE SINGULAR VALUE DECOMPOSITION BEING GIVEN).
- 34287 73 PSDINV CALCULATES THE PSEUDO-INVERSE OF A MATRIX.
- 34300 45 DEC PERFORMS A TRIANGULAR DECOMPOSITION WITH PARTIAL PIVOTING.
- 34301 49 DECSOL SOLVES A SYSTEM OF LINEAR EQUATIONS WHOSE ORDER IS SMALL RELATIVE TO THE NUMBER OF BINARY DIGITS IN THE NUMBER REPRESENTATION.
- 34302 51 DEGINV CALCULATES THE INVERSE OF A MATRIX WHOSE ORDER IS SMALL RELATIVE TO THE NUMBER OF BINARY DIGITS IN THE NUMBER REPRESENTATION.
- 34303 47 DETERM CALCULATES THE DETERMINANT OF A TRIANGULARLY DECOMPOSED MATRIX.
- 34310 55 CHLDEC2 CALCULATES THE CHOLESKY DECOMPOSITION OF A POSITIVE DEFINITE SYMMETRIC MATRIX WHOSE UPPER TRIANGLE IS GIVEN IN A TWO-DIMENSIONAL ARRAY.
- 34311 55 CHLDEC1 CALCULATES THE CHOLESKY DECOMPOSITION OF A POSITIVE DEFINITE SYMMETRIC MATRIX WHOSE UPPER TRIANGLE IS GIVEN COLUMNWISE IN A ONE-DIMENSIONAL ARRAY.
- 34312 57 CHLDETERM2 CALCULATES OF THE DETERMINANT OF A POSITIVE DEFINITE SYMMETRIC MATRIX, THE CHOLESKY DECOMPOSITION BEING GIVEN IN A TWO-DIMENSIONAL ARRAY.
- 34313 57 CHLDETERM1 CALCULATES THE DETERMINANT OF A POSITIVE DEFINITE SYMMETRIC MATRIX, THE CHOLESKY DECOMPOSITION BEING GIVEN COLUMNWISE IN A ONE-DIMENSIONAL ARRAY.
- 34320 75 DECBND PERFORMS A TRIANGULAR DECOMPOSITION OF A BAND MATRIX, USING PARTIAL PIVOTING.
- 34321 77 DETERMBND CALCULATES THE DETERMINANT OF A BAND MATRIX.
- 34322 79 DECSOLBND SOLVES A SYSTEM OF LINEAR EQUATIONS BY GAUSSIAN ELIMINATION WITH PARTIAL PIVOTING IF THE COEFFICIENT MATRIX IS IN BAND FORM AND IS STORED ROWWISE IN A ONE-DIMENSIONAL ARRAY.
- 34330 65 CHLDECBND PERFORMS THE CHOLESKY DECOMPOSITION OF A POSITIVE DEFINITE SYMMETRIC BAND MATRIX.
- 34331 67 CHLDETERMND CALCULATES THE DETERMINANT OF A POSITIVE DEFINITE SYMMETRIC BAND MATRIX.
- 34332 69 CHLSOLBND SOLVES A POSITIVE DEFINITE SYMMETRIC LINEAR SYSTEM, THE TRIANGULAR DECOMPOSITION BEING GIVEN.
- 34333 69 CHLDECSOLBND SOLVES A POSITIVE DEFINITE SYMMETRIC LINEAR SYSTEM AND PERFORMS THE TRIANGULAR DECOMPOSITION BY CHOLESKY'S METHOD.
- 34340 35 COMABS CALCULATES THE MODULUS OF A COMPLEX NUMBER.
- 34341 37 COMMUL CALCULATES THE PRODUCT OF TWO COMPLEX NUMBERS.
- 34342 37 COMDIV CALCULATES THE QUOTIENT OF TWO COMPLEX NUMBERS.
- 34343 35 COMSQRT CALCULATES THE SQUARE ROOT OF A COMPLEX NUMBER.
- 34344 35 CARPOL TRANSFORMS THE CARTESIAN COORDINATES OF A COMPLEX NUMBER INTO POLAR COORDINATES.
- 34345 129 COMKWD CALCULATES THE ROOTS OF A QUADRATIC EQUATION WITH COMPLEX COEFFICIENTS.
- 34352 21 COMCOLCST MULTIPLIES A COMPLEX COLUMN VECTOR BY A COMPLEX NUMBER.
- 34353 21 COMROWCST MULTIPLIES A COMPLEX ROW VECTOR BY A COMPLEX NUMBER.
- 34354 23 COMHATVEC CALCULATES THE SCALAR PRODUCT OF A COMPLEX ROW VECTOR AND A COMPLEX VECTOR.
- 34355 23 HSHCOMCOL TRANSFORMS A COMPLEX VECTOR INTO A VECTOR PROPORTIONAL TO A UNIT VECTOR.
- 34356 23 HSHCOMPRD PREMULTIPLIES A COMPLEX MATRIX WITH A COMPLEX HOUSEHOLDER MATRIX.
- 34357 27 ROTCOMCOL REPLACES TWO COMPLEX COLUMN VECTORS X AND Y BY TWO COMPLEX VECTORS $CX + SY$ AND $CY - SX$.
- 34358 27 ROTCOMROW REPLACES TWO COMPLEX ROW VECTORS X AND Y BY TWO COMPLEX VECTORS $CX + SY$ AND $CY - SX$.
- 34359 31 COMEUCNRM CALCULATES THE EUCLIDEAN NORM OF A COMPLEX MATRIX WITH LW LOWER CODIAGONALS.
- 34360 29 SOLCOM NORMALIZES THE COLUMNS OF A COMPLEX MATRIX.
- 34361 99 EQUILBRCOM EQUILIBRATES A COMPLEX MATRIX.
- 34362 99 BAKLBRCOM TRANSFORMS THE EIGENVECTORS OF A COMPLEX EQUILIBRATED (BY EQUILBRCOM) MATRIX INTO THE EIGENVECTORS OF THE ORIGINAL MATRIX.
- 34363 105 HSHHRMTRI TRANSFORMS A HERMITIAN MATRIX INTO A SIMILAR REAL SYMMETRIC TRIDIAGONAL MATRIX.
- 34364 105 HSHHRMTRIVAL DELIVERS THE MAIN DIAGONAL ELEMENTS AND THE SQUARES OF THE CODIAGONAL ELEMENTS OF A HERMITIAN TRIDIAGONAL MATRIX

- WHICH IS UNITARY SIMILAR WITH A GIVEN HERMITIAN MATRIX.
- 34365 105 BAKHRMTRI PERFORMS THE BACK TRANSFORMATION CORRESPONDING TO HSHHRMTRI.
- 34366 107 HSHCOMHES TRANSFORMS A COMPLEX MATRIX BY MEANS OF HOUSEHOLDER'S TRANSFORMATION FOLLOWED BY A COMPLEX DIAGONAL TRANSFORMATION INTO A SIMILAR UNITARY UPPER-HESSSENBERG MATRIX WITH A REAL NONNEGATIVE SUBDIAGONAL.
- 34367 107 BAKCOMHES PERFORMS THE BACK TRANSFORMATION CORRESPONDING TO HSHCOMHES.
- 34368 119 EIGVALHRM CALCULATES THE EIGENVALUES OF A COMPLEX HERMITIAN MATRIX.
- 34369 119 EIGHRM CALCULATES THE EIGENVALUES AND EIGENVECTORS OF A COMPLEX HERMITIAN MATRIX.
- 34370 119 QRIVALHRM CALCULATES THE EIGENVALUES OF A COMPLEX HERMITIAN MATRIX.
- 34371 119 QRHRM CALCULATES THE EIGENVALUES AND EIGENVECTORS OF A COMPLEX HERMITIAN MATRIX.
- 34372 121 VALQRICOM CALCULATES THE EIGENVALUES OF A COMPLEX UPPER-HESSSENBERG MATRIX WITH A REAL SUBDIAGONAL.
- 34373 121 QRICOM CALCULATES THE EIGENVECTORS AND THE EIGENVALUES OF A COMPLEX UPPER-HESSSENBERG MATRIX.
- 34374 123 EIGVALCOM CALCULATES THE EIGENVALUES OF A COMPLEX MATRIX.
- 34375 123 EIGCOM CALCULATES THE EIGENVECTORS AND EIGENVALUES OF A COMPLEX MATRIX.
- 34376 25 ELMCOMVECCOL ADDS A COMPLEX NUMBER TIMES A COMPLEX COLUMN VECTOR TO A COMPLEX VECTOR.
- 34377 25 ELMCOMCOL ADDS A COMPLEX NUMBER TIMES A COMPLEX COLUMN VECTOR TO A COMPLEX COLUMN VECTOR.
- 34378 25 ELMCOMROWVEC ADDS A COMPLEX NUMBER TIMES A COMPLEX VECTOR TO A COMPLEX ROW VECTOR.
- 34390 59 CHLSOL2 SOLVES A SYSTEM OF LINEAR EQUATIONS IF THE COEFFICIENT MATRIX HAS BEEN DECOMPOSED BY CHLDEC2 OR CHLDECSOL2.
- 34391 59 CHLSOL1 SOLVES A SYSTEM OF LINEAR EQUATIONS IF THE COEFFICIENT MATRIX HAS BEEN DECOMPOSED BY CHLDEC1 OR CHLDECSOL1.
- 34392 59 CHLDECSOL2 SOLVES A POSITIVE DEFINITE SYMMETRIC SYSTEM OF LINEAR EQUATIONS BY CHOLESKY'S SQUARE ROOT METHOD; THE COEFFICIENT MATRIX SHOULD BE GIVEN IN THE UPPER TRIANGLE OF A TWO-DIMENSIONAL ARRAY.
- 34393 59 CHLDECSOL1 SOLVES A POSITIVE DEFINITE SYMMETRIC SYSTEM OF LINEAR EQUATIONS BY CHOLESKY'S SQUARE ROOT METHOD; THE COEFFICIENT MATRIX SHOULD BE GIVEN COLUMNWISE IN A ONE-DIMENSIONAL ARRAY.
- 34400 61 CHLINV2 CALCULATES THE INVERSE OF A POSITIVE DEFINITE SYMMETRIC MATRIX, IF THE MATRIX HAS BEEN DECOMPOSED BY CHLDEC2 OR CHLDECSOL2.
- 34401 61 CHLINV1 CALCULATES THE INVERSE OF A POSITIVE DEFINITE SYMMETRIC MATRIX, IF THE MATRIX HAS BEEN DECOMPOSED BY CHLDEC1 OR CHLDECSOL1.
- 34402 61 CHLDECINV2 CALCULATES THE INVERSE OF A POSITIVE DEFINITE SYMMETRIC MATRIX BY CHOLESKY'S SQUARE ROOT METHOD; THE COEFFICIENT MATRIX GIVEN COLUMNWISE IN A TWO-DIMENSIONAL ARRAY.
- 34403 61 CHLDECINV1 CALCULATES THE INVERSE OF A POSITIVE DEFINITE SYMMETRIC MATRIX BY CHOLESKY'S SQUARE ROOT METHOD; THE COEFFICIENT MATRIX GIVEN COLUMNWISE IN A ONE-DIMENSIONAL ARRAY.
- 34410 39 LNGVECVEC CALCULATES THE SCALAR PRODUCT OF TWO VECTORS BY DOUBLE LENGTH ARITHMETIC.
- 34411 39 LNGMATVEC CALCULATES THE SCALAR PRODUCT OF A VECTOR AND A ROW VECTOR BY DOUBLE PRECISION ARITHMETIC.
- 34412 39 LNGTAMVEC CALCULATES THE SCALAR PRODUCT OF A VECTOR AND A COLUMN VECTOR BY DOUBLE PRECISION ARITHMETIC.
- 34413 39 LNGMATMAT CALCULATES THE SCALAR PRODUCT OF A ROW OF A VECTOR AND A COLUMN VECTOR BY DOUBLE PRECISION ARITHMETIC.
- 34414 39 LNGTAMMAT CALCULATES THE SCALAR PRODUCT OF TWO COLUMN VECTORS BY DOUBLE PRECISION ARITHMETIC.
- 34415 39 LNGMATTAM CALCULATES THE SCALAR PRODUCT OF TWO ROW VECTORS BY DOUBLE PRECISION ARITHMETIC.
- 34416 39 LNGSEQVEC CALCULATES THE SCALAR PRODUCT OF TWO VECTORS GIVEN IN ONE-DIMENSIONAL ARRAYS, WHERE THE MUTUAL SPACINGS BETWEEN THE INDICES OF THE 1ST VECTOR CHANGE LINEARLY, BY DOUBLE LENGTH ARITHMETIC.
- 34417 39 LNGSCAPRD1 CALCULATES THE SCALAR PRODUCT OF TWO VECTORS GIVEN IN ONE-DIMENSIONAL ARRAYS, WHERE THE SPACINGS OF BOTH VECTORS ARE CONSTANT, BY DOUBLE PRECISION ARITHMETIC.
- 34418 39 LNGSYHMATVEC CALCULATES THE SCALAR PRODUCT OF A VECTOR GIVEN IN A ONE-DIMENSIONAL ARRAY AND A ROW OF A SYMMETRIC MATRIX, WHOSE UPPER TRIANGLE IS STORED COLUMNWISE IN A ONE-DIMENSIONAL ARRAY, BY DOUBLE PRECISION ARITHMETIC.
- 34420 91 DECSYMTRI PERFORMS THE TRIANGULAR DECOMPOSITION OF A SYMMETRIC TRIDIAGONAL MATRIX.
- 34421 93 SOLSYMTRI SOLVES A SYMMETRIC TRIDIAGONAL SYSTEM OF LINEAR EQUATIONS, THE TRIANGULAR DECOMPOSITION BEING GIVEN.
- 34422 93 DECSOLSYMTRI SOLVES A SYMMETRIC TRIDIAGONAL SYSTEM OF LINEAR EQUATIONS AND PERFORMS THE TRIDIAGONAL DECOMPOSITION.
- 34423 81 DECTRI PERFORMS A TRIANGULAR DECOMPOSITION OF A TRIDIAGONAL MATRIX.
- 34424 83 SOLTRI SOLVES A TRIDIAGONAL SYSTEM OF LINEAR EQUATIONS THE TRIANGULAR DECOMPOSITION BEING GIVEN.
- 34425 83 DECSOLTRI SOLVES A TRIDIAGONAL SYSTEM OF LINEAR EQUATIONS AND PERFORMS THE TRIANGULAR DECOMPOSITION WITHOUT PIVOTING.
- 34426 81 DECTRIPIV PERFORMS A TRIANGULAR DECOMPOSITION OF A TRIDIAGONAL MATRIX, USING PARTIAL PIVOTING.
- 34427 83 SOLTRIPIV SOLVES A TRIDIAGONAL SYSTEM OF LINEAR EQUATIONS THE TRIANGULAR DECOMPOSITION BEING GIVEN.
- 34428 83 DECSOLTRIPIV SOLVES A TRIDIAGONAL SYSTEM OF LINEAR EQUATIONS AND PERFORMS THE TRIANGULAR DECOMPOSITION WITH PARTIAL PIVOTING.
- 34430 217 QUANEWBND SOLVES A SYSTEM OF NON-LINEAR EQUATIONS OF WHICH THE JACOBIAN (BEING A BAND MATRIX) IS GIVEN.
- 34431 217 QUANEWBND1 SOLVES A SYSTEM OF NON-LINEAR EQUATIONS OF WHICH THE JACOBIAN IS A BAND MATRIX.
- 34432 239 PRAXIS MINIMIZES A FUNCTION OF SEVERAL VARIABLES.
- 34433 235 MININ MINIMIZES A FUNCTION OF ONE VARIABLE IN A GIVEN INTERVAL.
- 34435 237 MININDER MINIMIZES A FUNCTION OF ONE VARIABLE IN A GIVEN INTERVAL, USING VALUES OF THE FUNCTION AND OF ITS DERIVATIVE.

- 34436 215 ZEROINRAT FINDS (IN A GIVEN INTERVAL) A ZERO OF A FUNCTION OF ONE VARIABLE.
- 34437 213 JACOBHNF CALCULATES THE JACOBIAN MATRIX OF AN N-DIMENSIONAL FUNCTION OF N VARIABLES USING FORWARD DIFFERENCES.
- 34438 213 JACOBHMF CALCULATES THE JACOBIAN MATRIX OF AN N-DIMENSIONAL FUNCTION OF M VARIABLES USING FORWARD DIFFERENCES.
- 34439 213 JACOBHNDF CALCULATES THE JACOBIAN MATRIX OF AN N-DIMENSIONAL FUNCTION OF N VARIABLES, IF THE JACOBIAN IS KNOWN TO BE A BAND MATRIX.
- 34440 219 MARQUARDT CALCULATES THE LEAST SQUARES SOLUTION OF AN OVERDETERMINED SYSTEM OF NON-LINEAR EQUATIONS WITH MARQUARDT'S METHOD.
- 34441 219 GSSNEWTON CALCULATES THE LEAST SQUARES SOLUTION OF AN OVERDETERMINED SYSTEM OF NON-LINEAR EQUATIONS WITH THE GAUSS-NEWTON METHOD.
- 34444 259 PEIDE ESTIMATES UNKNOWN PARAMETERS IN A SYSTEM OF 1ST ORDER DIFFERENTIAL EQUATIONS; THE UNKNOWN VARIABLES MAY APPEAR NON-LINEARLY BOTH IN THE DIFFERENTIAL EQUATIONS AND ITS INITIAL VALUES; A SET OF OBSERVED VALUES OF SOME COMPONENTS OF THE SOLUTION OF THE DIFFERENTIAL EQUATIONS MUST BE GIVEN.
- 34453 233 ZEROINDER FINDS (IN A GIVEN INTERVAL) A ZERO OF A FUNCTION OF ONE VARIABLE USING VALUES OF THE FUNCTION AND OF ITS DERIVATIVE.
- 34500 209 POLZEROS CALCULATES ALL ZEROS OF A POLYNOMIAL WITH REAL COEFFICIENTS.
- 34600 267 QZIVAL COMPUTES GENERALIZED EIGENVALUES BY MEANS OF QZ-ITERATION.
- 34601 267 QZI COMPUTES GENERALIZED EIGENVALUES AND EIGENVECTORS BY MEANS OF QZ-ITERATION.
- 34602 267 HSHDECMUL IS AN AUXILIARY PROCEDURE FOR THE COMPUTATION OF GENERALIZED EIGENVALUES.
- 34603 267 HESTGL3 IS AN AUXILIARY PROCEDURE FOR THE COMPUTATION OF GENERALIZED EIGENVALUES.
- 34604 267 HESTGL2 IS AN AUXILIARY PROCEDURE FOR THE COMPUTATION OF GENERALIZED EIGENVALUES.
- 34605 267 HSH2COL IS AN AUXILIARY PROCEDURE FOR THE COMPUTATION OF GENERALIZED EIGENVALUES.
- 34606 267 HSH3COL IS AN AUXILIARY PROCEDURE FOR THE COMPUTATION OF GENERALIZED EIGENVALUES.
- 34607 267 HSH2ROW3 IS AN AUXILIARY PROCEDURE FOR THE COMPUTATION OF GENERALIZED EIGENVALUES.
- 34608 267 HSH2ROW2 IS AN AUXILIARY PROCEDURE FOR THE COMPUTATION OF GENERALIZED EIGENVALUES.
- 34609 267 HSH3ROW3 IS AN AUXILIARY PROCEDURE FOR THE COMPUTATION OF GENERALIZED EIGENVALUES.
- 34610 267 HSH3ROW2 IS AN AUXILIARY PROCEDURE FOR THE COMPUTATION OF GENERALIZED EIGENVALUES.
- 34611 27 CHSH2 FINDS A COMPLEX ROTATION MATRIX.
- 34700 277 SYMDEC2 CALCULATES THE SYMMETRIC DECOMPOSITION OF A SYMMETRIC MATRIX WHOSE UPPER TRIANGLE IS GIVEN IN A TWO-DIMENSIONAL ARRAY.
- 34701 277 SYMDEC1 CALCULATES THE SYMMETRIC DECOMPOSITION OF A SYMMETRIC MATRIX WHOSE UPPER TRIANGLE IS GIVEN COLUMNWISE IN A ONE-DIMENSIONAL ARRAY.
- 34702 279 SYMDETERM2 CALCULATES THE DETERMINANT A SYMMETRIC MATRIX, THE SYMMETRIC DECOMPOSITION BEING GIVEN IN A TWO-DIMENSIONAL ARRAY.
- 34703 279 SYMDETERM1 CALCULATES THE DETERMINANT OF A SYMMETRIC MATRIX, THE SYMMETRIC DECOMPOSITION BEING GIVEN COLUMNWISE IN A ONE-DIMENSIONAL ARRAY.
- 34704 281 SYMSOL2 SOLVES A SYSTEM OF LINEAR EQUATIONS IF THE COEFFICIENT MATRIX HAS BEEN DECOMPOSED BY SYMDEC2 OR SYMDECSOL2.
- 34705 281 SYMSOL1 SOLVES A SYSTEM OF LINEAR EQUATIONS IF THE COEFFICIENT MATRIX HAS BEEN DECOMPOSED BY SYMDEC1 OR SYMDECSOL1.
- 34706 261 SYMDECSOL2 SOLVES A SYMMETRIC SYSTEM OF LINEAR EQUATIONS BY SYMMETRIC DECOMPOSITION (WITHOUT PIVOTING); THE COEFFICIENT MATRIX SHOULD BE GIVEN IN THE UPPERTRIANGLE OF A TWO-DIMENSIONAL ARRAY.
- 34707 281 SYMDECSOL1 SOLVES A SYMMETRIC SYSTEM OF LINEAR EQUATIONS BY SYMMETRIC DECOMPOSITION (WITHOUT PIVOTING); THE COEFFICIENT MATRIX SHOULD BE GIVEN COLUMNWISE IN A ONE-DIMENSIONAL ARRAY.
- 34708 281 SYMINV2 CALCULATES THE INVERSE OF A SYMMETRIC MATRIX, USING THE SYMMETRIC DECOMPOSITION FORMED BY SYMDEC2 OR SYMDECSOL2.
- 34709 283 SYMINV1 CALCULATES THE INVERSE OF A SYMMETRIC MATRIX, USING THE SYMMETRIC DECOMPOSITION FORMED BY SYMDEC1 OR SYMDECSOL1.
- 34710 263 SYMDECINV2 CALCULATES THE INVERSE OF A SYMMETRIC MATRIX BY A SYMMETRIC DECOMPOSITION (WITHOUT PIVOTING); THE COEFFICIENT MATRIX GIVEN COLUMNWISE IN A TWO-DIMENSIONAL ARRAY.
- 34711 263 SYMDECINV1 CALCULATES THE INVERSE OF A SYMMETRIC MATRIX BY A SYMMETRIC DECOMPOSITION (WITHOUT PIVOTING); THE COEFFICIENT MATRIX GIVEN COLUMNWISE IN A ONE-DIMENSIONAL ARRAY.
- 35021 227 ERKORFUNCTION COMPUTES THE ERROR FUNCTION (ERF) AND COMPLEMENTARY ERROR FUNCTION (ERFC) FOR A REAL ARGUMENT.
- 35022 227 NONEXPERFC COMPUTES $ERFC(X) * EXP(X*X)$.
- 35023 227 INVERSE ERROR FUNCTION CALCULATES THE INVERSE ERROR FUNCTION $Y = INVERF(X)$.
- 35027 227 FRESNEL CALCULATES THE FRESNEL INTEGRALS $C(X)$ AND $S(X)$.
- 35028 227 FG IS AN AUXILIARY PROCEDURE FOR THE COMPUTATION OF FRESNEL INTEGRALS.
- 35030 187 INCOMGAM COMPUTES THE INCOMPLETE GAMMA FUNCTIONS.
- 35050 187 INCBETA COMPUTES THE INCOMPLETE BETA-FUNCTION $I(X,P,Q)$; $0 \leq X \leq 1$, $P > 0$, $Q > 0$.
- 35051 187 IBPPLUSN COMPUTES INCOMPLETE BETA-FUNCTION RATIOS $I(X,P+N,Q)$ FOR $N = 0 (1) NMAX$, $0 \leq X \leq 1$, $P > 0$, $Q > 0$.
- 35052 187 IBQPLUSN COMPUTES INCOMPLETE BETA-FUNCTION RATIOS $I(X,P,Q+N)$ FOR $N = 0 (1) NMAX$, $0 \leq X \leq 1$, $P > 0$, $Q > 0$.
- 35053 187 IXQFIX IS AN AUXILIARY PROCEDURE FOR THE COMPUTATION OF INCOMPLETE BESSELFUNCTIONS.
- 35054 187 IXPFIX IS AN AUXILIARY PROCEDURE FOR THE COMPUTATION OF INCOMPLETE BESSELFUNCTIONS.

35056 187 BACKWARD IS AN AUXILIARY PROCEDURE FOR THE COMPUTATION OF INCOMPLETE BESSEL FUNCTIONS.
 35060 187 RECI GAMMA CALCULATES THE RECIPROCAL OF THE GAMMA FUNCTION FOR ARGUMENTS IN THE RANGE [0.5,1.5]; MOREOVER ODD AND EVEN PARTS ARE DELIVERED.
 35061 187 GAMMA CALCULATES THE GAMMA FUNCTION.
 35062 187 LOG GAMMA CALCULATES THE NATURAL LOGARITHM OF THE GAMMA FUNCTION FOR POSITIVE ARGUMENTS.
 35060 183 EI CALCULATES THE EXPONENTIAL INTEGRAL.
 35061 183 EI ALPHA CALCULATES A SEQUENCE OF INTEGRALS OF THE FORM INTEGRAL (EXP(-X*T)*T**N DT), FROM T=1 TO T=INFINITY.
 35063 41 JFRAC CALCULATES A TERMINATING CONTINUED FRACTION.
 35064 185 SINCOSINT CALCULATES THE SINE INTEGRAL SI(X) AND THE COSINE INTEGRAL CI(X).
 35065 185 SINCSFG IS AN AUXILIARY PROCEDURE FOR THE SINE AND COSINE INTEGRALS.
 35066 183 ENX COMPUTES A SEQUENCE OF EXPONENTIAL INTEGRALS E(N,X) = THE INTEGRAL FROM 1 TO INFINITY OF EXP(-X * T) / T**N DT.
 35067 183 NONEXP ENX COMPUTES A SEQUENCE OF INTEGRALS EXP(X) * E(N,X).
 35111 181 SINH COMPUTES THE HYPERBOLIC SINE FOR A REAL ARGUMENT X.
 35112 181 COSH COMPUTES THE HYPERBOLIC COSINE FOR A REAL ARGUMENT X.
 35113 181 TANH COMPUTES THE HYPERBOLIC TANGENT FOR A REAL ARGUMENT X.
 35114 181 ARCSINH COMPUTES THE INVERSE HYPERBOLIC SINE FOR A REAL ARGUMENT X.
 35115 181 ARCCOSH COMPUTES THE INVERSE HYPERBOLIC COSINE FOR A REAL ARGUMENT X.
 35116 181 ARCTANH COMPUTES THE INVERSE HYPERBOLIC TANGENT FOR A REAL ARGUMENT X.
 35120 179 TAN COMPUTES THE TANGENT FOR A REAL ARGUMENT X.
 35121 179 ARCSIN COMPUTES THE ARCSINE FOR A REAL ARGUMENT X.
 35122 179 ARCCOS COMPUTES THE ARCCOSINE FOR A REAL ARGUMENT X.
 35140 243 AIRY EVALUATES THE AIRY FUNCTIONS AI(Z) AND BI(Z) AND THEIR DERIVATIVES.
 35145 243 AIRYZEROS COMPUTES THE ZEROS AND ASSOCIATED VALUES OF THE AIRY FUNCTIONS AI(Z) AND BI(Z) AND THEIR DERIVATIVES.
 35150 247 SPHER BESS J CALCULATES THE SPHERICAL BESSEL FUNCTIONS OF THE 1ST KIND: J(K+.5)(X)*SQRT(PI/(2*X)), K=0,...,N, WHERE J(K+.5)(X) DENOTES THE BESSEL FUNCTION OF THE 1ST KIND OF ORDER K+.5.
 35151 247 SPHER BESS Y CALCULATES THE SPHERICAL BESSEL FUNCTIONS OF THE 3RD KIND: Y(K+.5)(X)*SQRT(PI/(2*X)), K=0,...,N, WHERE Y(K+.5)(X) DENOTES THE BESSEL FUNCTION OF THE 3RD KIND OF ORDER K+.5.
 35152 247 SPHER BESS I CALCULATES THE MODIFIED SPHERICAL BESSEL FUNCTIONS OF THE 1ST KIND: I(K+.5)(X)*SQRT(PI/(2*X)), K=0,...,N, WHERE I(K+.5)(X) DENOTES THE MODIFIED BESSEL FUNCTION OF THE 1ST KIND OF ORDER K+.5.
 35153 247 SPHER BESS K CALCULATES THE MODIFIED SPHERICAL BESSEL FUNCTIONS OF THE 3RD KIND: K(I+.5)(X)*SQRT(PI/(2*X)), I=0,...,N, WHERE K(I+.5)(X) DENOTES THE MODIFIED BESSEL FUNCTION OF THE 3RD KIND OF ORDER I+.5.
 35154 247 NONEXP SPHER BESS I CALCULATES THE MODIFIED SPHERICAL BESSEL FUNCTIONS OF THE 1ST KIND MULTIPLIED BY EXP(-X): I(K+.5)(X)*SQRT(PI/(2*X))*EXP(-X), K=0,...,N, WHERE I(K+.5)(X) DENOTES THE MODIFIED BESSEL FUNCTION OF THE 1ST KIND OF ORDER K+.5.
 35155 247 NONEXP SPHER BESS K CALCULATES THE MODIFIED SPHERICAL BESSEL FUNCTIONS OF THE 3RD KIND MULTIPLIED BY EXP(+X): K(I+.5)(X)*SQRT(PI/(2*X))*EXP(+X), I=0,...,N, WHERE K(I+.5)(X) DENOTES THE MODIFIED BESSEL OF THE 3RD KIND OF ORDER I+.5.
 35160 253 BESS J0 CALCULATES THE ORDINARY BESSEL FUNCTION OF THE 1ST KIND OF ORDER ZERO.
 35161 253 BESS J1 CALCULATES THE ORDINARY BESSEL FUNCTION OF THE 1ST KIND OF ORDER ONE.
 35162 253 BESS J CALCULATES THE ORDINARY BESSEL FUNCTIONS OF THE 1ST KIND OF ORDER L (L = 0,...,N).
 35163 253 BESS Y01 CALCULATES THE ORDINARY BESSEL FUNCTIONS OF THE 2ND KIND ORDER ZERO AND ONE WITH ARGUMENT X; X > 0.
 35164 253 BESS Y CALCULATES THE ORDINARY BESSEL FUNCTIONS OF THE 2ND KIND OF ORDER L (L = 0,...,N) WITH ARGUMENT X, X > 0.
 35165 253 BESS PQ0 IS AN AUXILIARY PROCEDURE FOR THE COMPUTATION OF THE ORDINARY BESSEL FUNCTIONS OF ORDER ZERO FOR LARGE VALUES OF THEIR ARGUMENT.
 35166 253 BESS PQ1 IS AN AUXILIARY PROCEDURE FOR THE COMPUTATION OF THE ORDINARY BESSEL FUNCTIONS OF ORDER ONE FOR LARGE VALUES OF THEIR ARGUMENT.
 35170 255 BESS I0 CALCULATES THE MODIFIED BESSEL FUNCTION OF THE 1ST KIND OF ORDER ZERO.
 35171 255 BESS I1 CALCULATES THE MODIFIED BESSEL FUNCTION OF THE 1ST KIND OF ORDER ONE.
 35172 255 BESS I CALCULATES THE MODIFIED BESSEL FUNCTIONS OF THE 1ST KIND OF ORDER L (L = 0,...,N).
 35173 255 BESS K01 CALCULATES THE MODIFIED BESSEL FUNCTIONS OF THE 3RD KIND OF ORDERS ZERO AND ONE WITH ARGUMENT X, X > 0.
 35174 255 BESS K CALCULATES THE MODIFIED BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER L (L = 0,...,N) WITH ARGUMENT X, X > 0.
 35175 255 NONEXP BESS I0 CALCULATES THE MODIFIED BESSEL FUNCTION OF THE 1ST KIND OF ORDER ZERO; THE RESULT IS MULTIPLIED BY EXP(-ABS(X)).
 35176 255 NONEXP BESS I1 CALCULATES THE MODIFIED BESSEL FUNCTION OF THE 1ST KIND OF ORDER ONE; THE RESULT IS MULTIPLIED BY EXP(-ABS(X)).
 35177 255 NONEXP BESS I CALCULATES THE MODIFIED BESSEL FUNCTIONS OF THE 1ST KIND OF ORDER L (L = 0,...,N); THE RESULT IS MULTIPLIED BY EXP(-ABS(X)).

- 35178 255 NONEXP BESS K01 CALCULATES THE MODIFIED BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER ZERO AND ONE WITH ARGUMENT X , $X > 0$; THE RESULT IS MULTIPLIED BY $\exp(X)$.
- 35179 255 NONEXP BESS K CALCULATES THE MODIFIED BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER L ($L = 0, \dots, N$) WITH ARGUMENT X , $X > 0$; THE RESULT IS MULTIPLIED BY $\exp(X)$.
- 35180 249 BESS JAPLUSN CALCULATES THE BESSEL FUNCTIONS OF THE 1ST KIND OF ORDER $A+K$ ($0 \leq K \leq N$, $0 \leq A < 1$).
- 35181 249 BESS YA01 CALCULATES THE BESSEL FUNCTIONS OF THE 2ND KIND (ALSO CALLED NEUMANN'S FUNCTIONS) OF ORDER A AND $A+1$ ($A \geq 0$) AND ARGUMENT $X > 0$.
- 35182 249 BESS YAPLUSN CALCULATES THE BESSEL FUNCTIONS OF THE 2ND KIND OF ORDER $A+N$, $N=0, \dots, NMAX$, $A \geq 0$, AND ARGUMENT $X > 0$.
- 35183 249 BESS PQA01 IS AN AUXILIARY PROCEDURE FOR THE COMPUTATION OF THE BESSEL FUNCTIONS FOR LARGE VALUES OF THEIR ARGUMENT.
- 35190 251 BESS IAPLUSN CALCULATES THE MODIFIED BESSEL FUNCTIONS OF THE 1ST KIND OF ORDER $A+N$, $N=0, \dots, NMAX$, $A \geq 0$ AND ARGUMENT $X \geq 0$.
- 35191 251 BESS KA01 CALCULATES THE MODIFIED BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER A AND $A+1$, $A \geq 0$, AND ARGUMENT X , $X > 0$.
- 35192 251 BESS KAPLUSN CALCULATES THE MODIFIED BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER $A+N$, $N=0, \dots, NMAX$, $A \geq 0$, AND ARGUMENT $X > 0$.
- 35193 251 NONEXP BESS IAPLUSN CALCULATES THE MODIFIED BESSEL FUNCTIONS OF THE 1ST KIND OF ORDER $A+N$, $N=0, \dots, NMAX$, $A \geq 0$ AND ARGUMENT $X \geq 0$, MULTIPLIED BY $\exp(-X)$.
- 35194 251 NONEXP BESS KA01 CALCULATES THE MODIFIED BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER A AND $A+1$, $A \geq 0$ AND ARGUMENT X , $X > 0$, MULTIPLIED BY THE FACTOR $\exp(X)$.
- 35195 251 NONEXP BESS KAPLUSN CALCULATES THE MODIFIED BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER $A+N$, $N=0, \dots, NMAX$, $A \geq 0$ AND ARGUMENT $X > 0$ MULTIPLIED BY THE FACTOR $\exp(X)$.
- 36010 195 NEWTON CALCULATES THE COEFFICIENTS OF THE NEWTON POLYNOMIAL THROUGH GIVEN INTERPOLATION POINTS AND CORRESPONDING FUNCTION VALUES.
- 36020 197 INI SELECTS A (SUB)SET OF INTEGERS OUT OF A GIVEN SET OF INTEGERS; IT IS AN AUXILIARY PROCEDURE FOR MINMAXPOL.
- 36021 197 SVOREMEZ EXCHANGES AT MOST $N+1$ NUMBERS WITH NUMBERS OUT OF A REFERENCE SET; IT IS AN AUXILIARY PROCEDURE FOR MINMAXPOL.
- 36022 197 MINMAXPOL CALCULATES THE COEFFICIENTS OF THE POLYNOMIAL THAT APPROXIMATES A FUNCTION, GIVEN FOR DISCRETE ARGUMENTS, SUCH THAT THE INFINITY NORM OF THE ERROR VECTOR IS MINIMISED.