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MC

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P.W. HEMKER (ed.)

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THE LIBRARY

NUMAL

OF ALGOL 60 PROCEDURES IN NUMERICAL MATHEMATICS

CONTENTS OF VOLUME 0

GENERAL INFORMATION AND INDICES

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 COMPUTOR/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:

FURTHER INFORMATION CAN BE OBTAINED FROM P.W. HEMKER, MANAGING EDITOR OF THE NUMAL PROJECT.

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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

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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.C. 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, CHAPTER6;
CDC INTERCOM REF. MANUAL, CHAPTER3, XEQ COMMAND.

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

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	DUPROWVEC	*	31032	APR/74	3
	DUPVECCOL	*	31033	APR/74	3
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	MULCOL	*	31022	APR/74	5
	COLCST	*	31131	APR/74	5
	ROWCST	*	31132	APR/74	5
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	TAMVEC	*	34012	DEC/75	7
	MATMAT	*	34013	DEC/75	7
	TAMMAT	*	34014	DEC/75	7
	MATTAM	*	34015	DEC/75	7
	SEQVEC	*	34016	DEC/75	7
	SCAPRD1	*	34017	DEC/75	7
	SYMMATVEC		34018	DEC/75	7
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	FULTAMVEC	*	31501	DEC/75	15
	FULSYMMATVEC		31502	DEC/75	15
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2.POLYNOMIALS				
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1.GENERAL FUNCTIONS				
2.POLYNOMIALS				
2.REAL DATA IN MORE DIMENSIONS				
3.REAL FUNCTIONS IN 1 DIMENSION				
1.POLYNOMIALS				
8.NUMBER THEORY				
9.TABLE HANDLING				
	READ	39999	NOT YET AVAILABLE	
	WRITE	39998	NOT YET AVAILABLE	

OBSOLETE PROCEDURES

PROCEDURE	CODE	WITHDRAWAL	EXPIRATION	REPLACED BY
DET	34050	730901	750701	DEC(3.1.1.1.1.1.1),DETERM(3.1.1.1.1.1.2)
LSQDEC	34130	730901	750701	LSQORTDEC(3.1.1.2.1.1)
ERF	35020	740501	750701	ERRORFUNCTION(6.7)
RK1N	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	INFNRMVEC(1.1.8)
MAXMAT	34230	750101	760101	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)
K0	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)

CODE	SECTION	PROCEDURE		MNT/YR
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		
31300	2. 5.	FFT		
31362	3. 6. 2.	ALLZERORTPOL		OCT/74
31363	3. 6. 2.	LUPZERORTPOL		OCT/74
31364	3. 6. 2.	SELZERORTPOL		OCT/74
31420	4. 2. 3.	GSSWGT		
31500	1. 1. 4. 2.	FULMATVEC	*	DEC/75
31501	1. 1. 4. 2.	FULTAMVEC	*	DEC/75
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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32051	4. 2. 1.	INTEGRAL	JUL/74
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.	ELMCOLROW	* APR/74

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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.	ROTROW	* 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

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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.	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
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
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.	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
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
34704	3. 1. 1. 1. 1. 3. 3.	SYMSOL2	JAN/76
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
35020	OBSOLETE PROCEDURE	ERF	
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

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.

ULATES THE MODIFIED SPHERICAL	BESSEL FUNCTIONS OF THE 1ST KIND MULTIPIED BY EXP(-X): I[K+.5](X)*SQRT(PI/(2*X))*EXP(-X),	35154	247
BESS JAPLUSN CALCULATES THE	BESSEL FUNCTIONS OF THE 1ST KIND OF ORDER A+K (0<=K<=N, 0<=A<1).	35180	249
PLUSN CALCULATES THE MODIFIED	BESSEL FUNCTIONS OF THE 1ST KIND OF ORDER A+N, N=0,...,NMAX , A>=0 AND ARGUMENT X>=0.	35190	251
PLUSN CALCULATES THE MODIFIED	BESSEL FUNCTIONS OF THE 1ST KIND OF ORDER A+N, N=0,...,NMAX , A>=0 AND ARGUMENT X>=0, MULT	35193	251
ESS J CALCULATES THE ORDINARY	BESSEL FUNCTIONS OF THE 1ST KIND OF ORDER L (L = 0,...,N).	35162	253
ESS I CALCULATES THE MODIFIED	BESSEL FUNCTIONS OF THE 1ST KIND OF ORDER L (L = 0,...,N).	35172	255
ESS I CALCULATES THE MODIFIED	BESSEL FUNCTIONS OF THE 1ST KIND OF ORDER L (L = 0,...,N); THE RESULT IS MULTIPLIED BY E	35177	255
ULATES 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)	35152	247
SS 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)	35150	247
BESS YA01 CALCULATES THE	BESSEL FUNCTIONS OF THE 2ND KIND (ALSO CALLED NEUMANN'S FUNCTIONS) OF ORDER A AND A+1 (	35181	249
BESS YAPLUSN CALCULATES THE	BESSEL FUNCTIONS OF THE 2ND KIND OF ORDER A+N, N=0,...,NMAX , A>=0, AND ARGUMENT X>0.	35182	249
ESS Y CALCULATES THE ORDINARY	BESSEL FUNCTIONS OF THE 2ND KIND OF ORDER L (L = 0,...,N) WITH ARGUMENT X, X> 0.	35164	253
S Y01 CALCULATES THE ORDINARY	BESSEL FUNCTIONS OF THE 2ND KIND ORDER ZERO AND ONE WITH ARGUMENT X; X > 0.	35163	253
ULATES THE MODIFIED SPHERICAL	BESSEL FUNCTIONS OF THE 3RD KIND MULTIPLIED BY EXP(+X): K[I+.5](X)*SQRT(PI/(2*X))*EXP(+X)	35155	247
KA01 CALCULATES THE MODIFIED	BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER A AND A+1, A>=0 AND ARGUMENT X, X>0, MULTIPLIED	35194	251
KA01 CALCULATES THE MODIFIED	BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER A AND A+1, A>=0, AND ARGUMENT X, X>0.	35191	251
PLUSN CALCULATES THE MODIFIED	BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER A+N, N=0,...,NMAX , A>=0 AND ARGUMENT X>0 MULTIP	35195	251
PLUSN CALCULATES THE MODIFIED	BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER A+N, N=0,...,NMAX , A>=0, AND ARGUMENT X>0.	35192	251
ESS K CALCULATES THE MODIFIED	BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER L (L = 0,...,N) WITH ARGUMENT X, X > 0.	35174	255
ESS K CALCULATES THE MODIFIED	BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER L (L = 0,...,N) WITH ARGUMENT X, X>0; THE RESU	35179	255
S K01 CALCULATES THE MODIFIED	BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER ZERO AND ONE WITH ARGUMENT X, X>0; THE RESULT IS	35178	255
S K01 CALCULATES THE MODIFIED	BESSEL FUNCTIONS OF THE 3RD KIND OF ORDERS ZERO AND ONE WITH ARGUMENT X, X > 0.	35173	255
ULATES 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)	35153	247
SS 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)	35151	247
CBETA COMPUTES THE INCOMPLETE	BETA-FUNCTION I(X,P,Q); 0 <= X <= 1, P > 0, Q > 0.	35050	187
IBPPLUSN COMPUTES INCOMPLETE	BETA-FUNCTION RATIOS I(X,P+N,Q) FOR N = 0 (1) NMAX, 0 <= X <= 1, P > 0, Q > 0.	35051	187
IBQPLUSN COMPUTES INCOMPLETE	BETA-FUNCTION RATIOS I(X,P,Q+N) FOR N = 0 (1) NMAX, 0 <= X <= 1, P > 0, Q > 0.	35052	187
THE AIRY FUNCTIONS AI(Z) AND	BI(Z) AND THEIR DERIVATIVES.	35140	243
REABID TRANSFORMS A MATRIX TO	BIDIAGONAL FORM, BY PREMULTIPLYING AND POSTMULTIPLYING WITH ORTHOGONAL MATRICES.	34260	109
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E REAL EIGENVALUES (ELLIPTIC	BOUNDARY VALUE PROBLEM) BY MEANS OF A NON-STATIONARY 2ND ORDER ITERATIVE METHOD.	33170	225
E REAL EIGENVALUES (ELLIPTIC	BOUNDARY VALUE PROBLEM) BY MEANS OF A NON-STATIONARY 2ND ORDER ITERATIVE METHOD, WHICH IS	33171	225
SYM SOLVES A LINEAR TWO-POINT	BOUNDARY-VALUE PROBLEM FOR A FOURTH ORDER SELF-ADJOINT DIFFERENTIAL EQUATION WITH DIRICHLE	33303	265
KEW SOLVES A LINEAR TWO-POINT	BOUNDARY-VALUE PROBLEM FOR A SECOND ORDER DIFFERENTIAL EQUATION BY A RITZ-GALERKIN METHOD.	33302	263
SYM SOLVES A LINEAR TWO-POINT	BOUNDARY-VALUE PROBLEM FOR A SECOND ORDER SELF-ADJOINT DIFFERENTIAL EQUATION BY A RITZ-GAL	33301	261
LAG SOLVES A LINEAR TWO-POINT	BOUNDARY-VALUE PROBLEM FOR A SECOND ORDER SELF-ADJOINT DIFFERENTIAL EQUATION BY A RITZ-GAL	33300	261
	CARPOL TRANSFORMS THE CARTESIAN COORDINATES OF A COMPLEX NUMBER INTO POLAR COORDINATES.	34344	35
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CHEPOL EVALUATES A	CHEBYSHEV POLYNOMIAL.	31042	229
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	CHEPOL EVALUATES A CHEBYSHEV POLYNOMIAL.	31042	229
	CHEPOLSER EVALUATES A CHEBYSHEV SERIES.	31046	229
	CHLDECBND PERFORMS THE CHOLESKY DECOMPOSITION OF A POSITIVE DEFINITE SYMMETRIC BAND MATRIX	34330	85
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	CHLDECSOLBND SOLVES A POSITIVE DEFINITE SYMMETRIC LINEAR SYSTEM AND PERFORMS THE TRIANGULA	34333	89
	CHLDECSOL1 SOLVES A POSITIVE DEFINITE SYMMETRIC SYSTEM OF LINEAR EQUATIONS BY CHOLESKY'S S	34393	59
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	CHLINV1 CALCULATES THE INVERSE OF A POSITIVE DEFINITE SYMMETRIC MATRIX, IF THE MATRIX HAS	34401	61

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 DPSUB 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,...,K <= DEGREE.
31243 245 DERPOL EVALUATES THE FIRST K DERIVATIVES OF A POLYNOMIAL.
31248 205 INTCHS COMPUTES THE INDEFINITE INTEGRAL OF A GIVEN CHEBYSHEV SERIES.
31362 211 ALLZERORTPOL CALCULATES ALL ZEROS OF AN ORTHOGONAL POLYNOMIAL.
31363 211 LUPZERORTPOL CALCULATES A NUMBER OF ADJACENT UPPER OR LOWER ZEROS OF AN ORTHOGONAL POLYNOMIAL.
31364 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'.

34436 215 ZEROINRAT FINDS (IN A GIVEN INTERVAL) A ZERO OF A FUNCTION OF ONE VARIABLE.
34437 213 JACOBNNF CALCULATES THE JACOBIAN MATRIX OF AN N-DIMENSIONAL FUNCTION OF N VARIABLES USING FORWARD DIFFERENCES.
34438 213 JACOBNMF CALCULATES THE JACOBIAN MATRIX OF AN N-DIMENSIONAL FUNCTION OF M VARIABLES USING FORWARD DIFFERENCES.
34439 213 JACOBNBNDF 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 281 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 283 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 283 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 ERRORFUNCTION 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 <= X <= 1, P > 0, Q > 0.
35051 187 IBPPLUSN COMPUTES INCOMPLETE BETA-FUNCTION RATIOS I(X,P+N,Q) FOR N = 0 (1) NMAX, 0 <= X <= 1, P > 0, Q > 0.
35052 187 IBQPLUSN COMPUTES INCOMPLETE BETA-FUNCTION RATIOS I(X,P,Q+N) FOR N = 0 (1) NMAX, 0 <= X <= 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 BESSELFUNCTIONS.
35060 187 RECIP GAMMA CALCULATES THE RECIPROCAL OF THE GAMMA FUNCTION FOR ARGUMENTS IN THE RANGE [.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.
35080 183 EI CALCULATES THE EXPONENTIAL INTEGRAL .
35081 183 EI ALPHA CALCULATES A SEQUENCE OF INTEGRALS OF THE FORM INTEGRAL (EXP(-X*T)*T**N DT), FROM T=1 TO T=INFINITY.
35083 41 JFRAC CALCULATES A TERMINATING CONTINUED FRACTION.
35084 185 SINCOSINT CALCULATES THE SINE INTEGRAL SI(X) AND THE COSINE INTEGRAL CI(X).
35085 185 SINCOSFG IS AN AUXILIARY PROCEDURE FOR THE SINE AND COSINE INTEGRALS.
35086 183 ENX COMPUTES A SEQUENCE OF EXPONENTIAL INTEGRALS E(N,X) = THE INTEGRAL FROM 1 TO INFINITY OF EXP(-X * T)/ T**N DT.
35087 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 MULTIPIED 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)).