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MC

DEPARTMENT OF NUMERICAL MATHEMATICS NW 8/76 FEBRUARY

P.W. HEMKER (ed.)

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

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THE LIBRARY

NUMAL

OF ALGOL 60 PROCEDURES IN NUMERICAL MATHEMATICS

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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:

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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

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.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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INDEX	PROCEDURE	CODE	MNT/YR	RECORD NUMBER
3. 6. 2.	SELZERORTPOL	31364	OCT/74	211
3.ZEROS OF COMPLEX POLYNOMIALS	COMKWD	34345	JUL/74	129
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1.EVAL. OF AN INFINITE SERIES	EULER	32010	JUL/74	131
	SUMPOSSERIES	32020	JUL/74	131
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1.ONE-DIMENSIONAL QUADRATURE	QADRAT	32070	JUL/74	133
	INTEGRAL	32051	JUL/74	135
2.MULTIDIMENSIONAL QUADRATURE	TRICUB	32075	OCT/75	257
3.GAUSSIAN WEIGHTS	RECCOF	31249	NOT YET AVAILABLE	
	GSSWGT	31420	NOT YET AVAILABLE	
3.NUMERICAL DIFFERENTIATION				
1.FUNCTIONS OF ONE VARIABLE				
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1.CALC. WITH DIFFERENCE FORMULAS	JACOBNNF	34437	OCT/74	213
	JACOBNMF	34438	OCT/74	213
	JACOBNBNDF	34439	OCT/74	213
5.ANALYTICAL PROBLEMS				
1.ANALYTICAL EQUATIONS				
1.NON-LINEAR EQUATIONS				
1.A SINGLE EQUATION				
1.NO DERIVATIVE AVAILABLE	ZEROIN	34150	OCT/75	215
	ZEROINRAT	34436	OCT/75	215
2.DERIVATIVE AVAILABLE	ZEROINDER	34453	OCT/75	233
2.A SYSTEM OF EQUATIONS				
1.AUXILIARY PROCEDURES				
2.JACOBIAN MATRIX NOT AVAILABLE	BROWNLS	34450	NOT YET AVAILABLE	
	QUANEW	34451	NOT YET AVAILABLE	
	QUANEW1	34452	NOT YET AVAILABLE	
	QUANEWBND	34430	OCT/74	217
	QUANEWBND1	34431	OCT/74	217
3.JACOBIAN MATRIX AVAILABLE	NEWRAP	34202	NOT YET AVAILABLE	
	DAMPED NEWTON	34200	NOT YET AVAILABLE	
3.POLYNOMIAL EQUATIONS SEE ALSO SECTION 3.6				
2.UNCONSTRAINED OPTIMIZATION				
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2.DERIVATIVE AVAILABLE	MININDER	34435	OCT/75	237
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5. 1. 2. 2. 1.	RNK1UPD	34211	DEC/75	139

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	FLEUPD	34213	DEC/75	139
2.NO DERIVATIVES AVAILABLE				
	PRAXIS	34432	OCT/75	239
3.GRADIENT AVAILABLE				
	RNK1MIN	34214	DEC/75	19
	FLEMIN	34215	DEC/75	19
4.GRADIENT & JACOBIAN AVAILABLE				
	NEWTONMIN	34203	NOT YET AVAILABLE	
3.OVERDETERMINED NONLINEAR SYST.				
1.LEAST SQUARES SOLUTIONS				
SEE ALSO SECTION 7.				
1.AUXILIARY PROCEDURES				
2.JACOBIAN MATRIX NOT AVAILABLE				
SEE ALSO SECTION 5.1.2.2.2.				
3.JACOBIAN MATRIX AVAILABLE				
	MARQUARDT	34440	DEC/75	219
	GSSNEWTON	34441	DEC/75	219
2.FUNCTIONAL EQUATIONS				
1.DIFFERENTIAL EQUATIONS				
1.INITIAL VALUE PROBLEMS				
1.FIRST ORDER ORDINARY D.E.				
1.NO DERIVATIVES RHS AVAILABLE				
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	RKE	33033	DEC/75	143
	RK4A	33016	AUG/74	145
	RK4NA	33017	AUG/74	147
	RK5NA	33018	AUG/74	149
	MULTISTEP	33080	AUG/74	151
	DIFFSYS	33180	AUG/74	153
	ARK	33061	DEC/75	155
	EFRK	33070	AUG/74	157
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	EFERK	33120	AUG/74	161
	LINIGER1VS	33132	OCT/74	221
	LINIGER2	33131	AUG/74	165
	IMPEX	33135	OCT/75	231
	GMS	33191	OCT/74	223
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3.SEVERAL DERIVATIVES AVAILABLE				
	MODIFIED TAYLOR	33040	AUG/74	167
	EXPONENTIALLY FITTED TAYLOR	33050	AUG/74	169
2.SECOND ORDER ORDINARY D.E.				
1.NO DERIVATIVES RHS AVAILABLE				
SEE ALSO SECTION 5.2.1.1.2.1.				
	RK2	33012	AUG/74	171
	RK2N	33013	AUG/74	173
	RK3	33014	AUG/74	175
	RK3N	33015	AUG/74	177
2.SEVERAL DERIV. RHS AVAILABLE				
3.PARTIAL DIFFERENTIAL EQUATIONS				
2.BOUNDARY VALUE PROBLEMS				
5. 2. 1. 2. 1.TWO POINT B.V.P.				

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2.LINEAR GLOBAL METHODS				
1.SECOND ORDER TPBVP				
1.SELF ADJOINT TPBVP				
	FEM LAG	33300	JAN/76	261
	FEM LAG SYM	33301	JAN/76	261
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	FEM LAG SKEW	33302	JAN/76	263
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1.SELF ADJOINT TPBVP				
	FEM HERM SYM	33303	JAN/76	265
2.SKEW ADJOINT TPBVP				
3.NON-LINEAR GLOBAL METHODS				
2.TWO-DIMENSIONAL B.V.P.				
1.ELLIPTIC B.V.P.S				
1.DISCRETIZATION PROCEDURES				
2.SPECIAL LINEAR SYSTEMS				
	RICHARDSON	33170	OCT/74	225
	ELIMINATION	33171	OCT/74	225
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3.SPECIAL NON-LINEAR SYSTEMS				
2.PARABOLIC & HYPERBOLIC B.V.P.S				
3.MULTI-DIMENSIONAL B.V.P.				
4.OVER-DETERMINED PROBLEMS				
3.PARAMETER ESTIMATION IN D.E.				
1.P.E. IN INITIAL VALUE PROBLEMS				
	PEIDE	34444	OCT/75	259
2.INTEGRAL EQUATIONS				
3.INTEGRO- DIFFERENTIAL EQS				
4.DIFFERENCE EQUATIONS				
5.CONVOLUTION EQUATIONS				
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2.MACHINE CONSTANTS				
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	ARREB	* 30002	JAN/76	275
	DWARF	* 30003	JAN/76	275
	GIANT	* 30004	JAN/76	275
	INTCAP	* 30005	JAN/76	275
	OVERFLOW	* 30008	JAN/76	275
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	ARCCOS	35122	SEP/74	179
2.HYPERBOLIC FUNCTIONS				
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6. 4. 2.	COSH	35112	SEP/74	181

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	ARCSINH	35114	SEP/74	181
	ARCCOSH	35115	SEP/74	181
	ARCTANH	35116	SEP/74	181
5.EXPONENTIAL INTEGRAL, ETC.				
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	EI	35080	SEP/74	183
	EI ALPHA	35081	SEP/74	183
	ENX	35086	SEP/74	183
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2.SINE AND COSINE INTEGRAL				
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	SINCOSFG	35085	SEP/74	185
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	RECIP GAMMA	35060	SEP/74	187
	LOG GAMMA	35062	SEP/74	187
	INCOMGAM	35030	SEP/74	187
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	FRESNEL	35027	OCT/74	227
	FG	35028	OCT/74	227
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9.BESSEL FUNCTIONS OF INT. ORDER				
1.BESSEL FUNCTIONS J AND Y				
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	BESS J1	35161	OCT/75	253
	BESS J	35162	OCT/75	253
	BESS Y01	35163	OCT/75	253
	BESS Y	35164	OCT/75	253
	BESS PQ0	35165	OCT/75	253
	BESS PQ1	35166	OCT/75	253
2.BESSEL FUNCTIONS I AND K				
	BESS I0	35170	OCT/75	255
	BESS I1	35171	OCT/75	255
	BESS I	35172	OCT/75	255
	BESS K01	35173	OCT/75	255
	BESS K	35174	OCT/75	255
	NONEXP BESS I0	35175	OCT/75	255
	NONEXP BESS I1	35176	OCT/75	255
	NONEXP BESS I	35177	OCT/75	255
	NONEXP BESS K01	35178	OCT/75	255
	NONEXP BESS K	35179	OCT/75	255
3.KELVIN FUNCTIONS				
10.BESSEL FUNCTIONS OF REAL ORDER				
6. 10. 1.BESSEL FUNCTIONS J AND Y				

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	BESS YA01	35181	OCT/75	249
	BESS YAPLUSN	35182	OCT/75	249
	BESS PQA01	35183	OCT/75	249
2.BESSEL FUNCTIONS I AND K				
	BESS IAPLUSN	35190	OCT/75	251
	BESS KA01	35191	OCT/75	251
	BESS KAPLUSN	35192	OCT/75	251
	NONEXP BESS IAPLUSN	35193	OCT/75	251
	NONEXP BESS KA01	35194	OCT/75	251
	NONEXP BESS KAPLUSN	35195	OCT/75	251
3.SPHERICAL BESSEL FUNCTIONS				
	SPHER BESS J	35150	OCT/75	247
	SPHER BESS Y	35151	OCT/75	247
	SPHER BESS I	35152	OCT/75	247
	SPHER BESS K	35153	OCT/75	247
	NONEXP SPHER BESS I	35154	OCT/75	247
	NONEXP SPHER BESS K	35155	OCT/75	247
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	AIRYZEROS	35145	OCT/75	243
7.INTERPOLATION & APPROXIMATION				
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1.INTERPOLATION, WITH				
1.POLYNOMIALS				
1.GENERAL POLYNOMIALS				
	NEWTON	36010	SEP/74	195
2.ORTHOGONAL POLYNOMIALS				
2.SPLINES				
1.GENERAL SPLINES				
2.NATURAL SPLINES				
3.TRIGONOMETRIC SERIES				
1.FOURIER SERIES				
2.SINE SERIES				
3.COSINE SERIES				
4.RATIONAL FUNCTIONS				
5.EXPONENTIAL FUNCTIONS				
2.APPROXIMATION IN 2-NORM, WITH				
1.GENERAL FUNCTIONS				
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2.POLYNOMIALS				
1.GENERAL POLYNOMIALS				
2.ORTHOGONAL POLYNOMIALS				
3.SPLINES				
1.GENERAL SPLINES				
2.NATURAL SPLINES				
4.TRIGONOMETRIC SERIES				
5.RATIONAL FUNCTIONS				
6.EXPONENTIAL FUNCTIONS				
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1.GENERAL FUNCTIONS				
2.POLYNOMIALS				
1.GENERAL POLYNOMIALS				
	INI	36020	DEC/75	197
7. 1. 3. 2. 1.	SNDREMEZ	36021	DEC/75	197

INDEX	PROCEDURE	CODE	MNT/YR	RECORD NUMBER
7. 1. 3. 2. 1.	MINMAXPOL	36022	OCT/75	197
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3.TRIGONOMETRIC SERIES				
4.RATIONAL FUNCTIONS				
4.APPROXIMATION IN 1-NORM, WITH				
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)

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30001	6. 2.	MBASE	* JAN/76
30002	6. 2.	ARREB	* JAN/76
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
30010	6. 3.	RANDOM	
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.	INISYMROW	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	
31057	2. 4. 2.	INTPOL	
31060	OBSOLETE PROCEDURE	ABSMAXVEC	
31061	1. 1. 8.	INFNRMVEC	* OCT/75
31062	1. 1. 8.	INFNRMROW	* 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.	ABSMAXMAT	* OCT/75
31070	1. 1. 4. 3.	HSHVECMAT	* JAN/76

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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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.	QRISNGVALDECBID	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.	SOLSVDOVR	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

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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

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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

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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.

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	INIVEC INITIALIZES A VECTOR WITH A CONSTANT.	31010	1
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CT COMPUTES THE DIFFERENCE OF	LONG NONNEGATIVE INTEGERS.	31201	201
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RNK1MIN	MINIMIZES A FUNCTION OF SEVERAL VARIABLES.	34214	19
FLEMIN	MINIMIZES A FUNCTION OF SEVERAL VARIABLES.	34215	19
PRAXIS	MINIMIZES A FUNCTION OF SEVERAL VARIABLES.	34432	239
	MININ MINIMIZES A FUNCTION OF ONE VARIABLE IN A GIVEN INTERVAL.	34433	235
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NONEXP BESS I0 CALCULATES THE	MODIFIED BESSEL FUNCTION OF THE 1ST KIND OF ORDER ZERO; THE RESULT IS MULTIPLIED BY EXP(-A	35175	255
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P BESS KAPLUSN CALCULATES THE	MODIFIED BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER A+N, N=0,...,NMAX , A>=0 AND ARGUMENT X	35195	251
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ONEXP BESS K01 CALCULATES THE	MODIFIED BESSEL FUNCTIONS OF THE 3RD KIND OF ORDER ZERO AND ONE WITH ARGUMENT X, X>0; THE	35178	255
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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)).
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