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MTH\$GASIN
Table of contents

; G Floating Point Sine routine N 5

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(5) 170
(6) 239
(7) 299

HISTORY ; Detailed Current Edit History
DECLARATIONS ; Declarative Part of Module
MTH\$GASIN - Standard G Floating GASIN
MTH\$GASIN_R7 - Special GASIN routine
MTH\$GASIND - Standard G Floating GASIND
MTH\$GASIND_R7 - Special GASIND routine


```
0000 1      .TITLE  MTH$GASIN      ; G Floating Point Sine routine
0000 2      ; (GASIN,GASIND)
0000 3      .IDENT /1-005/        ; File: MTHGASIN.MAR  EDIT:  RNH1005
0000 4      ;
0000 5      ;*****
0000 6      ;
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0000 23     ; SOFTWARE ON EQUIPMENT WHICH IS NOT SUPPLIED BY DIGITAL.
0000 24     ;
0000 25     ;
0000 26     ;*****
0000 27     ;
0000 28     ;
0000 29     ; FACILITY: MATH LIBRARY
0000 30     ;++
0000 31     ; ABSTRACT:
0000 32     ;
0000 33     ; MTH$GASIN is a function which returns the G floating point arcsine in
0000 34     ; radians of its G floating point argument. The call is standard
0000 35     ; call-by-reference.
0000 36     ;
0000 37     ; MTH$GASIND is a function which returns the G floating point arcsine
0000 38     ; in degrees of its G floating point argument. The call is standard
0000 39     ; call-by-reference.
0000 40     ;
0000 41     ;--
0000 42     ;
0000 43     ; VERSION: 1
0000 44     ;
0000 45     ; HISTORY:
0000 46     ; AUTHOR:
0000 47     ; Steven B. Lionel, 15-Jan-79: Version 1
0000 48     ;
0000 49     ; MODIFIED BY:
0000 50     ;
0000 51     ;
0000 52     ;
```

MTH\$GASIN
1-005

C 6
; G Floating Point Sine routine 16-SEP-1984 01:24:49 VAX/VMS Macro V04-00
HISTORY ; Detailed Current Edit History 6-SEP-1984 11:23:19 [MTHRTL.SRC]MTHGASIN.MAR;1 Page 2
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```
0000 54      .SBTTL HISTORY ; Detailed Current Edit History
0000 55
0000 56
0000 57 : ALGORITHMIC DIFFERENCES FROM FP-11/C ROUTINE: none
0000 58 :
0000 59 : Edit History for Version 1 of MTH$GASIN
0000 60 :
0000 61 : 1-001 - Adapted from MTH$DASIN version 1-001. SBL 15-Jan-79
0000 62 : 1-002 - Change JSB entry to MTH$GASIN R7. RBG 28-Sept-1979
0000 63 : 1-003 - Added degree entry points. RNH 29-MAR-1981
0000 64 : 1-004 - Changed shared external references to G^ RNH 25-Sept-1981
0000 65 : 1-005 - Eliminate symbolic short literals. RNH 15-Oct-81
```



```
0000 67      .SBTTL  DECLARATIONS      ; Declarative Part of Module
0000 68
0000 69 :
0000 70 : INCLUDE FILES:      OTSPARAMS.MAR
0000 71 :
0000 72 : EXTERNAL SYMBOLS:
0000 73
0000 74      .DSABL  GBL              ; Force error for undefineds
0000 75      .EXTRN  MTH$GSQRT_R5      ; Square root routine
0000 76      .EXTRN  MTH$GATAN_R7      ; Arctangent routine
0000 77      .EXTRN  MTH$GATAN_R7      ; Arctangent routine
0000 78      .EXTRN  MTH$SSIGNAL      ; Math signal routine
0000 79      .EXTRN  MTH$K_INVARGMAT    ; Error code
0000 80
0000 81 :
0000 82 : EQUATED SYMBOLS:
0000 83
00000004 0000 84      value      = 4              ; value.rg.r
0000 85
0000 86 :
0000 87 : MACROS:      none
0000 88 :
0000 89 : PSECT DECLARATIONS:
0000 90
00000000 0000 91      .PSECT  _MTH$CODE      PIC,SHR,LONG,EXE,NOWRT
0000 92      ; program section for math routines
0000 93 :
0000 94 : OWN STORAGE:  none
0000 95 :
0000 96 :
0000 97 : CONSTANTS:
0000 98 :
0000 99 :
2D18 5444 21FB 4019 0000 100 G_PI_OVER_2:
0000 101      .WORD      ^0040031, ^0020773, ^0052104, ^0026430
0008 102      ; PI/2
0008 103 G_PI:
2D18 5444 21FB 4029 0008 104      .WORD      ^0040051, ^0020773, ^0052104, ^0026430
0010 105      ; PI
0010 106 G_90:
00000000 80004076 0010 107      .LONG      ^X80004076, ^X0              ; 90
0018 108
```

```
0018 110 .SBTTL MTH$GASIN - Standard G Floating GASIN
0018 111
0018 112
0018 113 :++
0018 114 : FUNCTIONAL DESCRIPTION:
0018 115 :
0018 116 : GASIN - G floating point function
0018 117 :
0018 118 : GASIN(X) is computed as:
0018 119 :
0018 120 : If X = 0, then GASIN(X) = 0.
0018 121 : If X = 1, then GASIN(X) = PI/2.
0018 122 : If X = -1, then GASIN(X) = -PI/2.
0018 123 : If 0 < |X| < 1, then GASIN(X) = ATAN(X/SQRT(1-X**2)).
0018 124 : If 1 < |X|, error.
0018 125 :
0018 126 : CALLING SEQUENCE:
0018 127 :
0018 128 : gasin.wg.v = MTH$GASIN(x.rg.r)
0018 129 :
0018 130 : INPUT PARAMETERS:
0018 131 :
00000004 0018 132 : LONG = 4 ; define longword multiplier
00000004 0018 133 : x = 1 * LONG ; Contents of x is the argument
0018 134 :
0018 135 : IMPLICIT INPUTS: none
0018 136 :
0018 137 : OUTPUT PARAMETERS:
0018 138 :
0018 139 : VALUE: G floating arcsine of the argument
0018 140 :
0018 141 : IMPLICIT OUTPUTS: none
0018 142 :
0018 143 : COMPLETION CODES: none
0018 144 :
0018 145 : SIDE EFFECTS:
0018 146 :
0018 147 : Signals: MTH$_INVARGMAT if |X| > 1 with reserved operand in R0/R1
0018 148 : (copied to the signal mechanism vector CHF$MCH_R0/R1 by LIB$SIGNAL).
0018 149 : Associated message is: "INVALID ARGUMENT". Result is reserved
0018 150 : operand -0.0 unless a user supplied (or any) error handler changes CHF$MCH_R0/R1
0018 151 :
0018 152 : NOTE: This procedure disables floating point underflow, enables integer
0018 153 : overflow.
0018 154 :
0018 155 : ---
0018 156 :
0018 157 :
0018 158 : .ENTRY MTH$GASIN, ^M<IV, R2, R3, R4, R5, R6, R7>
001A 159 : ; standard call-by-reference entry
001A 160 : ; disable DV (and FU), enable IV
001A 161 : MTH$FLAG_JACKET ; flag that this is a jacket procedure in
001A
6D 00000000'GF 9E 001A MOVAB G^MTH$$JACKET_HND, (FP) ; set handler address to jacket
0021 ; handler
0021
0021
```



```

; G Floating Point Sine routine
MTH$GASIN - Standard G Floating GASIN

```

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			0021	162			; case of an error in routine
			0021	163			; If an error, convert signal to user PC
			0021	164			; and resignal
50	04	BC	50FD	0021	165	MOVG	@value(AP), R0
		01	10	0026	166	BSBB	MTH\$GASIN_R7
			04	0028	167	RET	; call special GASIN routine
				0029	168		; return with result in R0/R1


```
0029 170 .SBTTL MTH$GASIN_R7 - Special GASIN routine
0029 171
0029 172 ; Special GASIN - used by the standard routine and direct JSB call.
0029 173
0029 174 ; CALLING SEQUENCE:
0029 175 ; save anything needed in R0:R7
0029 176 ; MOVG R0 ; input in R0/R1
0029 177 ; JSB MTH$GASIN_R7
0029 178 ; RSB ; return with result in R0/R1
0029 179
0029 180
0029 181 MTH$GASIN_R7:: ; special GASIN routine
0029 182 MTH$GASIN_R9:: ; Release 1 name
0029 183 ; MOVG R0, R6 ; save X in R6/R7
002D 184 ; BEQL RETURN ; return DASIN(0) = 0
002F 185
002F 186
002F 187 ; 0 < !X!
002F 188
002F 189
002F 190 ; BICW #^X8000, R0 ; R0/R1 = !X!
0034 191 ; CMPG R0, #1 ; compare !X! with 1.0
0038 192 ; BGEQ GEQ_TO_1.0 ; branch if !X! >= 1.0
003A 193
003A 194
003A 195 ; 0 < !X! < 1.0
003A 196
003A 197
003A 198 ; MULG2 R0, R0 ; R0/R1 = X**2
003E 199 ; SUBG3 R0, #1, R0 ; R0/R1 = 1.0 - X**2
0043 200 ; JSB MTH$GSQRT_R5 ; R0/R1 = GSQRT(1-X**2)
0049 201 ; DIVG3 R0, R6, R0 ; R0/R1 = X/GSQRT(1-X**2)
004E 202 ; JMP G^MTH$GATAN_R7 ; R0/R1 = GATAN(X/GSQRT(1-X**2))
0054 203
0054 204
0054 205
0054 206 ; 1 <= !X!
0054 207
0054 208
0054 209 GEQ_TO_1.0:
0054 210 ; BGTR ERROR ; branch to ERROR if !X! > 1.0
0056 211
0056 212
0056 213
0056 214 ; !X! = 1.0
0056 215
0056 216
0056 217 ; MOVQ G PI_OVER_2, R0 ; R0/R1 = PI/2
005A 218 ; TSTG R6 ; test the sign of X
005D 219 ; BGEQ RETURN ; branch if X > 0
005F 220 ; MNEGG R0, R0 ; R0/R1 = -PI/2
0063 221 RETURN: RSB ; return with result in R0/R1
0064 222
0064 223
0064 224 ; 1 < !X!, error
0064 225
0064 226
```

MTH\$GASIN
1-005

H 6
; G Floating Point Sine routine
MTH\$GASIN_R7 - Special GASIN routine

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```

      7E 00 6E DD 0064 227 ERROR: PUSHL (SP) ; return PC from JSB routine
      50 01 8F 9A 0066 228 MOVZBL #MTH$K_INVARGMAT, -(SP) ; condition value
      OF 79 006A 229 ASHQ #15, #T, R0 ; R0 = result = reserved operand -0.0
      00000000'GF 02 FB 006E 230 ; goes to signal mechanism vector
      006E 231 ; (CHF$MCH_R0/R1) so error handler
      006E 232 ; can modify the result.
      0075 233 CALLS #2, G^MTH$$SIGNAL ; signal error and use real user's PC
      05 0075 234 ; independent of CALL vs JSB
      0076 235 RSB ; return - R0 restored from CHF$MCH_R0/R1
      0076 236
      237
```



```
0076 239 .SBTTL MTH$GASIND - Standard G Floating GASIND
0076 240
0076 241
0076 242 :++
0076 243 : FUNCTIONAL DESCRIPTION:
0076 244 :
0076 245 : GASIND - G floating point function
0076 246 :
0076 247 : GASIND(X) is computed as:
0076 248 :
0076 249 :     If X = 0, then GASIND(X) = 0.
0076 250 :     If X = 1, then GASIND(X) = 90.
0076 251 :     If X = -1, then GASIND(X) = -90.
0076 252 :     If 0 < |X| < 1, then GASIND(X) = ATAND(X/SQRT(1-X**2)).
0076 253 :     If 1 < |X|, error.
0076 254 :
0076 255 : CALLING SEQUENCE:
0076 256 :
0076 257 :     gasind.wg.v = MTH$GASIND(x.rg.r)
0076 258 :
0076 259 : INPUT PARAMETERS:
0076 260 :
00000004 0076 261 :     LONG = 4 ; define longword multiplier
00000004 0076 262 :     x = 1 * LONG ; Contents of x is the argument
0076 263 :
0076 264 : IMPLICIT INPUTS: none
0076 265 :
0076 266 : OUTPUT PARAMETERS:
0076 267 :
0076 268 :     VALUE: G floating arcsine of the argument
0076 269 :
0076 270 : IMPLICIT OUTPUTS: none
0076 271 :
0076 272 : COMPLETION CODES: none
0076 273 :
0076 274 : SIDE EFFECTS:
0076 275 :
0076 276 : Signals: MTH$_INVARGMAT if |X| > 1 with reserved operand in R0/R1
0076 277 : (co90ed to the signal mechanism vector CHF$$_MCH_R0/R1 by LIB$$_SIGNAL).
0076 278 : Associated message is: "INVALID ARGUMENT". Result is reserved
0076 279 : operand -0.0 unless a user supplied (or any) error handler changes CHF$$_MCH_R0/R1
0076 280 :
0076 281 : NOTE: This procedure disables floating point underflow, enables integer
0076 282 : overflow.
0076 283 :
0076 284 : ---
0076 285 :
0076 286 :
0076 287 : .ENTRY MTH$GASIND, ^M<IV, R2, R3, R4, R5, R6, R7>
0078 288 : ; standard call-by-reference entry
0078 289 : ; disable DV (and FU), enable IV
0078 290 : MTH$FLAG_JACKET ; flag that this is a jacket procedure in
0078
0078
007F MOVAB G^MTH$$_JACKET_HND, (FP)
007F ; set handler address to jacket
007F ; handler
```

```

; G Floating Point Sine routine      J 6
MTHSGASIND - Standard G Floating GASIND  16-SEP-1984 01:24:49  VAX/VMS Macro V04-00  Page 9
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```

				007F	291		
				007F	292		
				007F	293		
50	04	BC	50FD	007F	294	MOVG	aValue(AP), R0
		01	10	0084	295	BSBB	MTH\$GASIND_R7
			04	0086	296	RET	
				0087	297		

```

; case of an error in routine
; If an error, convert signal to user PC
; and resignal
; R0/R1 = !X! = avalue(AP)
; call special GASIND routine
; return with result in R0/R1

```



```
0087 299 .SBTTL MTH$GASIND_R7 - Special GASIND routine
0087 300
0087 301 ; Special GASIND - used by the standard routine and direct JSB call.
0087 302
0087 303 CALLING SEQUENCE:
0087 304 ; save anything needed in R0:R7
0087 305 MOVG R0 ; input in R0/R1
0087 306 JSB MTH$GASIND_R7
0087 307 RSB ; return with result in R0/R1
0087 308
0087 309
0087 310 MTH$GASIND_R7:: ; special GASIND routine
0087 311 MOVG R0, R6 ; save X in R6/R7
0087 312 BEQL D_RETURN ; return DASIND(0) = 0
008D 313
008D 314 ;
008D 315 ; 0 < |X|
008D 316 ;
008D 317
008D 318 BICW #^X8000, R0 ; R0/R1 = |X|
0092 319 CMPL R0, #1 ; compare |X| with 1.0
0096 320 BGEQ D_GEQ_TO_1.0 ; branch if |X| >= 1.0
0098 321
0098 322 ;
0098 323 ; 0 < |X| < 1.0
0098 324 ;
0098 325
0098 326 MULG2 R0, R0 ; R0/R1 = X**2
009C 327 SUBG3 R0, #1, R0 ; R0/R1 = 1.0 - X**2
00A1 328 JSB MTH$GSQRT_R5 ; R0/R1 = GSQRT(1-X**2)
00A7 329 DIVG3 R0, R6, R0 ; R0/R1 = X/GSQRT(1-X**2)
00AC 330 JMP G^MTH$GATAND_R7 ; R0/R1 = GATAND(X/GSQRT(1-X**2))
00B2 331
00B2 332
00B2 333 ;
00B2 334 ; 1 <= |X|
00B2 335 ;
00B2 336
00B2 337 D_GEQ_TO_1.0:
00B2 338 BGTR ERROR ; branch to ERROR if |X| > 1.0
00B4 339
00B4 340
00B4 341 ;
00B4 342 ; |X| = 1.0
00B4 343 ;
00B4 344
00B4 345 MOVQ G 90, R0 ; R0/R1 = 90
00B9 346 TSTG R0 ; test the sign of X
00BC 347 BGEQ D_RETURN ; branch if X > 0
00BE 348 MNEGG R0, R0 ; R0/R1 = -90
00C2 349 D_RETURN: RSB ; return with result in R0/R1
00C3 350
00C3 351
00C3 352 .END
```

MTH\$GASIN
Symbol table

; G Floating Point Sine routine

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[MTHRTL.SRC]MTHGASIN.MAR;1

(7)

D_GEQ_TO_1.0	000000B2	R	01
D_RETURN	000000C2	R	01
ERROR	00000064	R	01
GEQ_TO_1.0	00000054	R	01
G_90	00000010	R	01
G_PI	00000008	R	01
G_PI_OVER_2	00000000	R	01
LONG	= 00000004		
MTH\$\$JACKET_HND	*****	X	01
MTH\$\$SIGNAL	*****	X	00
MTH\$GASIN	00000018	RG	01
MTH\$GASIND	00000076	RG	01
MTH\$GASIND_R7	00000087	RG	01
MTH\$GASIN_R7	00000029	RG	01
MTH\$GASIN_R9	00000029	RG	01
MTH\$GATAN_R7	*****	X	00
MTH\$GATAN_R7	*****	X	00
MTH\$GSQRT_R5	*****	X	00
MTH\$K_INVARGMAT	*****	X	00
RETURN	00000063	R	01
VALUE	= 00000004		

! Psect synopsis !

PSECT name

Allocation

PSECT No.

Attributes

ABS	00000000 (0.)	00 (0.)	NOPIC	USR	CON	ABS	LCL	NOSHR	NOEXE	NORD	NOWRT	NOVEC	BYTE
MTH\$CODE	000000C3 (195.)	01 (1.)	PIC	USR	CON	REL	LCL	SHR	EXE	RD	NOWRT	NOVEC	LONG

! Performance indicators !

Phase	Page faults	CPU Time	Elapsed Time
Initialization	31	00:00:00.10	00:00:01.03
Command processing	112	00:00:00.65	00:00:03.93
Pass 1	94	00:00:00.96	00:00:03.43
Symbol table sort	0	00:00:00.01	00:00:00.01
Pass 2	72	00:00:00.79	00:00:03.74
Symbol table output	3	00:00:00.02	00:00:00.09
Psect synopsis output	2	00:00:00.03	00:00:00.10
Cross-reference output	0	00:00:00.00	00:00:00.00
Assembler run totals	316	00:00:02.57	00:00:12.47

The working set limit was 900 pages.

5179 bytes (11 pages) of virtual memory were used to buffer the intermediate code.

There were 10 pages of symbol table space allocated to hold 22 non-local and 0 local symbols.

412 source lines were read in Pass 1, producing 14 object records in Pass 2.

1 page of virtual memory was used to define 1 macro.

+-----+
! Macro library statistics !
+-----+

Macro library name

Macros defined

_S255\$DUA28:[SYSLIB]STARLET.MLB;2

0

0 GETS were required to define 0 macros.

There were no errors, warnings or information messages.

MACRO/ENABLE=SUPPRESSION/DISABLE=(GLOBAL,TRACEBACK)/LIS=LIS\$:MTHGASIN/OBJ=OBJ\$:MTHGASIN MSRC\$:MTHJACKET/UPDATE=(ENH\$:MTHJACKET)+MSRC

0260 AH-BT13A-SE
VAX/VMS V4.0

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