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FFCG—A Free-Form Input Combinatorial Geometry Package

S. K. Fraley

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S. K. Fraley, Originator *

D. E. Bartine, Sponsor
Engineering Physics Division

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NOTICE

This document contains information of a preliminary nature. It is subject to revision or correction and therefore does not represent a final report.

*Present address: U. S. Arms Control & Disarmament Agency
Room 4953
Washington, DC 20451

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FFCG - A Free-Form Input Combinatorial Geometry Package

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ABSTRACT

The FFCG package is a version of the combinatorial geometry module for use in MORSE-SGC which will allow the use of free-form data input. A description of how combinatorial geometry may be used to describe a three-dimensional geometry system is presented, and an input description for the FFCG package is given. Also an input description for SKETCH, a version of PICTURE for use with FFCG, is described.

INTRODUCTION

The combinatorial geometry package allows the description of the shape of physical structures by the combination of certain basic geometric shapes (bodies) such as rectangular parallelepipeds, right circular cylinders, etc. (A complete list of these basic shapes is given in the input description.)

These basic shapes are combined using three logical operators: 1) OR, 2) AND, and 3) NOT. The OR operator is used explicitly and the AND and NOT operators are used implicitly.

An input zone is a physical shape which is described by a string of basic shapes (bodies) and logical operators.

The geometry package will subdivide each input zone into code zones which can be described without the use of the OR operator, so that each input zone consists of one or more code zones.

In addition to describing the shape of an input zone, it is also necessary to indicate which cross-section information is to be used. Each material (mixture) for which cross-section data is stored during problem execution is assigned a media number. An input zone can contain only one medium. Each input zone, therefore, has associated with it a media number (not necessarily unique). This associated media number may be set to 0 or 1000 as flags to indicate external voids or internal voids, respectively. External voids are used to indicate when a particle has leaked from the system under consideration. Any particle which enters an external void is assumed to leak. The system under consideration must be completely surrounded by external void as a flag to stop tracking a particle when it leaks. Internal void is a vacuum through which particles travel without any interaction.

In many problems it is desirable to use different Russian roulette kill weights, survival weights, etc., in different parts of the geometry. To do this, one or more importance region or regions are used. An input zone must be within a single region; and, therefore, each input zone has associated with it a region number.

DESCRIPTION OF BODY TYPES

The information required to specify each type of body is as follows:

a. Rectangular Parallelepiped (RPP) -- Specify the minimum and maximum values of the x, y, and z coordinates which bound the parallelepiped. The RPP must have sides which are parallel to the coordinate axes.

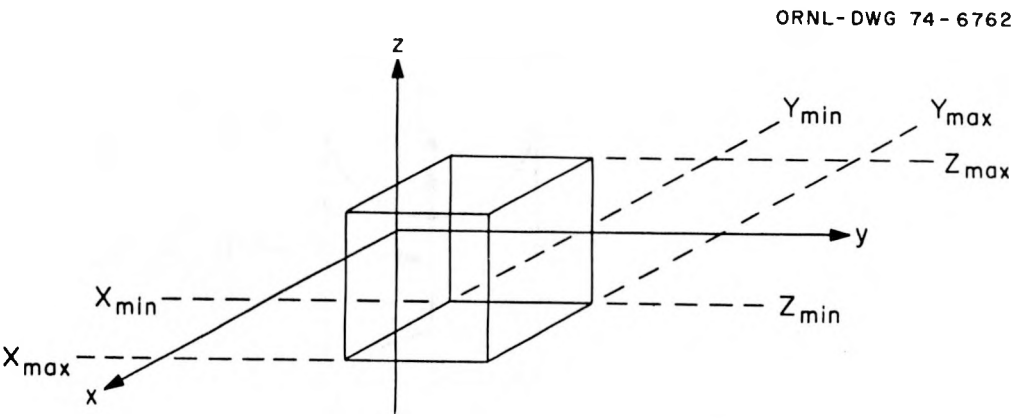


Figure 1. Rectangular Parallelepiped (RPP).

b. Sphere (SPH) -- Specify the vertex $\underline{V}$ at the center and the scalar, R, denoting the radius.

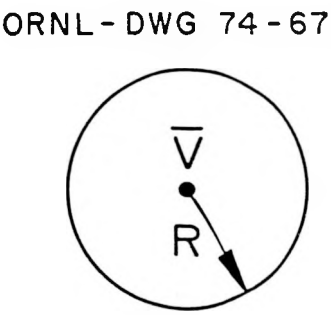


Figure 2. Sphere (SPH).

c. Right Circular Cylinder (RCC) -- Specify the vertex $\underline{V}$ at the center of one base, a height vector, $\underline{H}$, expressed in terms of its x, y, and z components, and a scalar, R, denoting the radius.

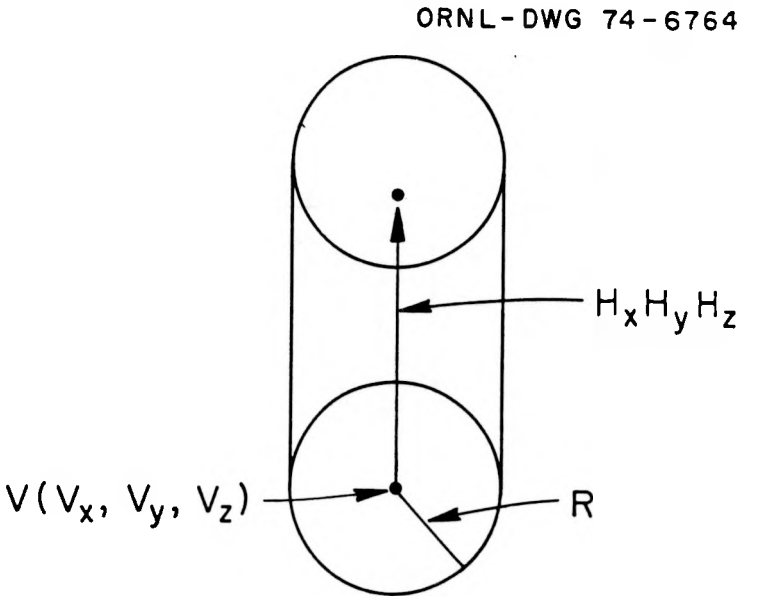


Figure 3. Right Circular Cylinder (RCC).

d. Right Elliptical Cylinder (REC) -- Specify coordinates of the center of the base ellipse, a height vector, and two vectors in the plane of the base defining the major and minor axes.

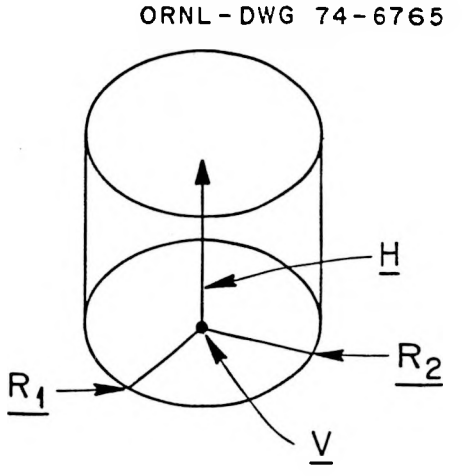


Figure 4. Right Elliptical Cylinder (REC).

e. Truncated Right Angle Cone (TRC) -- Specify a vertex $\underline{V}$ at the center of the lower base, the height vector, $\underline{H}$, expressed in terms of its x, y, z components, and two scalars, R_1 and R_2, denoting the radii of the lower and upper bases.

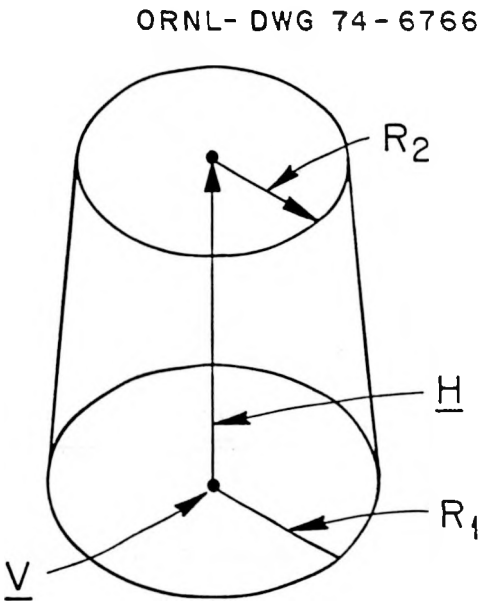


Figure 5. Truncated Right Angle Cone (TRC).

f. Ellipsoid (ELL) -- Specify two vertices, $\underline{V_1}$ and $\underline{V_2}$, denoting the coordinates of the foci and a scalar, R, denoting the length of the major axis.

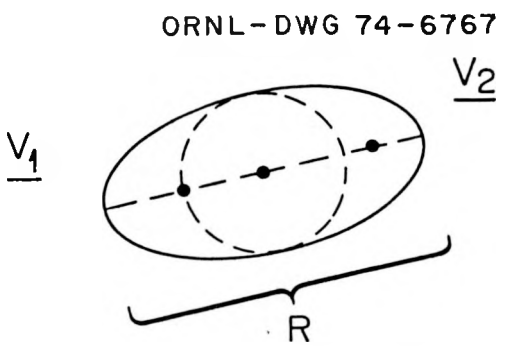


Figure 6. Ellipsoid (ELL).

g. Wedge (WED) or (RAW) -- Specify the vertex $\underline{V}$ at one of the corners by giving its (x,y,z) coordinates. Specify a set of three mutually perpendicular vectors, $\underline{a_i}$, with a_1 and a_2 describing the two legs of the right triangle of the wedge. That is, the x, y, and z components of the height, width, and length vectors are given.

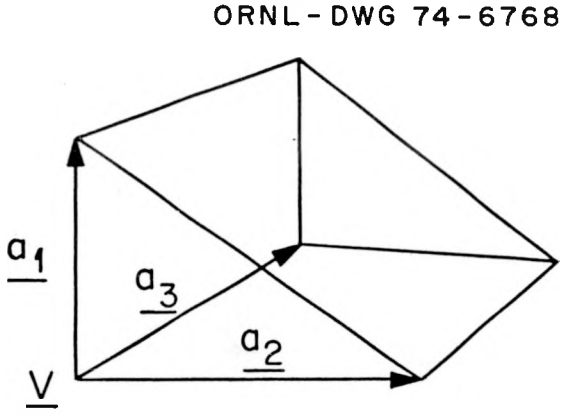


Figure 7. Right Angle Wedge (WED).

h. Box (BOX) -- Specify the vertex $\underline{V}$ at one of the corners by giving its (x,y,z) coordinates. Specify a set of three mutually perpendicular vectors, a_i, representing the height, width, and length of the box, respectively. That is, the x, y, and z components of the height, width, and length vectors are given.

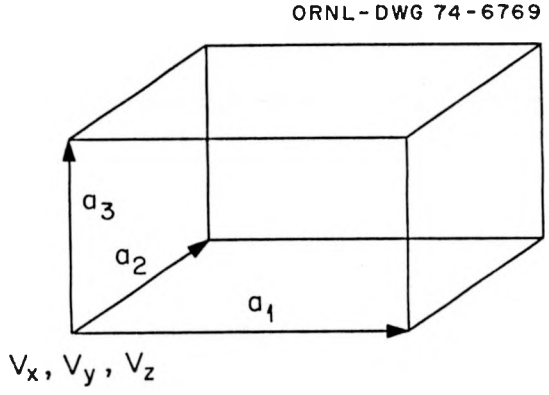


Figure 8. Box (BOX)

i. Arbitrary Polyhedron (ARB) -- Assign an index (1 to 8) to each vertex. For each vertex, give the x, y, z coordinates. Each of the six faces is then described by a four-digit number giving the indices of the four vertex points in that face. For each face these indices must be entered in either clockwise or counterclockwise order.

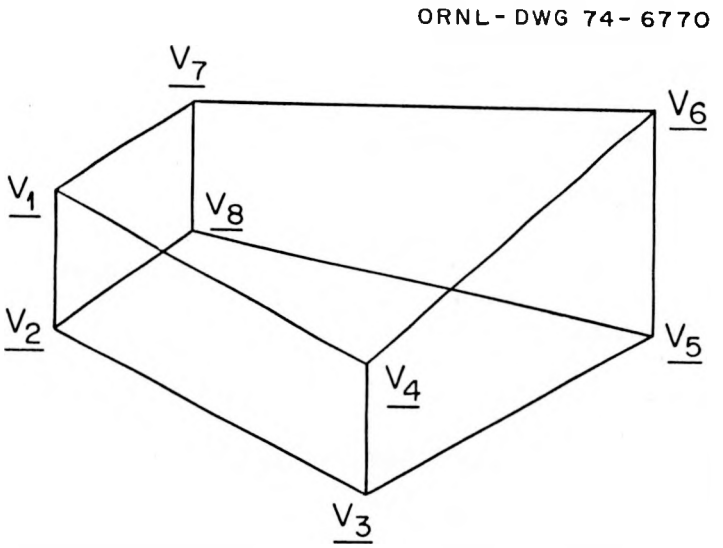


Figure 9. Arbitrary Polyhedron (ARB).

DESCRIPTION OF INPUT ZONES

An input zone is described by a string of body numbers and logical operators. The body numbers correspond to specific bodies which have been defined using the body types described in the previous section. The operators used are OR, + and -. The correspondence between OR, +, and - operators and the logical OR, AND, and NOT operators is as follows:

1 or 2 ↔ 1.OR.2

1 +2 ↔ 1.AND.2

1 -2 ↔ 1.AND.(NOT.2)

-1 -2 ↔ (.NOT.1).AND.(NOT.2)

-1 or -2 ↔ (.NOT.1).OR.(.NOT.2)

In the hierarchy of operations, all + and - operations are performed before the OR operator.

For example,

1 -2 OR -3 +4 ↔ (1.AND.(.NOT.2)).OR.((.NOT.3).AND.4)

NOTE: This version of combinatorial geometry differs from previous versions in that a leading OR operator is not necessary if OR's are used in the input zone description. It may be used if desired.

DATA INPUT FORMAT FOR FFCG

Title Card (60A1)

Options Card (four entries required) free-form input

IVOPT option which defines the method by which region volumes are determined; if IVOPT = 0, volumes set equal to 1,
IVOPT = 1, concentric sphere volumes are calculated
IVOPT = 2, slab volume (1-dim.) are calculated,*
IVOPT = 3, volumes are input by card.

IDBG if IDBG>0, subroutine PR is called to print results of combinatorial geometry calculations during execution. Use only for debugging. Three levels of debug print are available by setting IDBG - 1, 2, or 3.

IBOD body numbers are assigned by the user on the body definition cards if IBOD>0.

NAZ number of additional locations to be allocated for geometry tracking memory. This number will be added to the standard allocation of five times the number of input zones.

Body Definition Cards Free-Form Input

The information required for each body is summarized in Table 1. Each body definition must start on a new card. More than one card may be used to define a body. For each body the following information is needed:

*Not operational.

Body type, body number (if IBOD>0), real data as shown in Table 1.

An END card must be used to signify the end of the body definition cards.

If body numbers are assigned by the user (IBOD>0), they must form a sequence set beginning at 1. If body numbers are not assigned by the user (IBOD=0), the body numbers will be assigned sequentially.

Input Zone Description Cards — Free-Form Input

Each new zone must start on a new card. A three-character title must be given for each input zone (not necessarily unique) which must start with an alphabetic character. For each input zone, the following information is needed: Zone title, zone data.

An END card must be used to signify the end of the input zone description cards.

Region Numbers — Free-Form Input

Region numbers for each input zone.

Universe Numbers — Free-Form Input

Universe Numbers for each input zone. (Use zeroes now.)

Media Numbers — Free-Form Input

Media numbers for each input zone.

Volumes (if IVOPT=3) — Free-Form Input

Volumes of each region.

Table 1. Input Required on Body Definition Cards for Each Body Type

Body Type	ITYPE	IALP	Real Data Defining Particular Body					
Box	BOX	IALP[a]	Vx	Vy	Vz	H1x	H1y	H1z
			H2x	H2y	H2z	H3x	H3y	H3z
Right parallelepiped	RPP		Xmin	Xmax	Ymin	Ymax	Zmin	Zmax
Sphere	SPH		Vx	Vy	Vz	R	-	-
Right circular cylinder	RCC		Vx	Vy	Vz	Hx	Hy	Hz
			R	-	-	-	-	-
Right elliptic cylinder	REC		Vx	Vy	Vz	Hx	Hy	Hz
			R1x	R1y	R1z	R2x	R2y	R2z
Ellipsoid	ELL		V1x	V1y	V1z	V2x	V2y	V2z
			L	-	-	-	-	-
Truncated right cone	TRC		Vx	Vy	Vz	Hx	Hy	Hz
			L1	L2	-	-	-	-
Right angle wedge	WED		Vx	Vy	Vz	H1x	H1y	H1z
			H2x	H2y	H2z	H3x	H2y	H3z
Arbitrary polyhedron	ARB		V1x	V1y	V1z	V2x	V2y	V2z
			V3x	V3y	V3z	V4x	V4y	V4z
			V5x	V5y	V5z	V6x	V6y	V6z
			V7x	V7y	V7z	V8x	V8y	V8z
			Face descriptions[b]					
Termination of body input data	END							

[a] IALP is the body number. It is assigned by the user only if IBOD>0, otherwise it should be left blank.

[b] The arbitrary polyhedron input contains a four-digit number for each of the six faces of an ARB body. See the ARB write-up in Section 3 for an example.

FREE-FORM INPUT RULES FOR FFCG

1) R, *, and $ are used for repeats. For example, 4R 5.0, 4*5.0, and 4$5.0 will all give 5.0 5.0 5.0 5.0. A blank may be used after the R, *, or $ but is not necessary.
2) Repeated zeroes may be obtained using a Z option. For example, 4Z will give 0 0 0 0.
3) No more than two digits may be used in an exponent. The following forms are allowable:

   1.0E 4

   1.0E 04

   1E4

   1D4

   1+4

4) There are no restrictions on the use of fixed or floating point numbers.

SKETCH is a version of the PICTURE code[2] which is available for use with the free-form combinatorial geometry input data. The input data requirements for SKETCH differ from those of PICTURE[2] in that an additional card has been added for a print factor to account for differing lines per inch printed by various printers. If six lines are printed per inch, then a print factor of 6 should be entered; if eight lines are printed per inch, then a print factor of 8 should be entered (assuming that the standard of 10 characters per inch is printed on each line).

INPUT DATA FOR SKETCH

1. Card PO: (free-form input)

   PFACT: A print factor (6 for 6 lines per inch, 8 for 8 lines per inch)

2. Card PA: Format (I5)

   NUSE: The number of characters to be read on Card B to replace the standard values of ATABLE. Leave Card A blank and omit Card B if the standard ATABLE is desired. NUSE $\leq$ 50.

3. Card PB: Format (50A1) (omit if NUSE = 0)

   ATABLE (I), I=1,NUSE: The list of characters that are to be printed for each medium. For medium, N, ATABLE (N+1) is printed. If N $\geq$ 47, ATABLE (48) is printed. The standard values of ATABLE are:

Medium Number	Character Printed
0 (external void)	
1 through 9	1 through 9
10 through 35	A through Z
36 through 46	various special characters
$\geq$ 47 (including internal voids)	(blank)

4. GEOM Input: Free-form combinatorial geometry input.

5. Card PC: Format (2I2, 18A4)

   INCT:
   - = 0 after this picture, return to Card PC for another picture with the same geometry.
   - = 1 after this picture, read in a new GEOM input (step 3 above).

   IRG:
   - = -1 display the region geometry
   - = 0 display the zone geometry
   - = 1 display the material geometry

   TITLE(I),I=1,18: 72 characters to be printed as a title.

6. Card PD: Format (6E10.5)

X_{UL}, X_{UL}, X_{UL} — X, Y, and Z coordinates in the combinatorial geometry of the upper left corner of the picture

X_{LR}, X_{LR}, X_{LR} — X, Y, and Z coordinates in the combinatorial geometry of the lower right corner of the picture

NOTE: Card PD partially describes the plane of the slice by defining two points in the plane and designates the top, bottom, and left and right sides of the picture.

7. Card PE: Format (6E10.5)

U_X, U_Y, U_Z — Direction numbers proportional to the direction cosines for the U axis of the picture. The U axis points down the printed page in the direction the page moves through the printer.

V_X, V_Y, V_Z — Direction numbers for the V axis of the picture. The V axis points to the right across the page.

NOTE: Card PE completes the description of the plane of the slice by giving a line in the plane; it also specifies the orientation of the picture on the output.

8. Card PF: Format (2I5, 2E10.5)

NU: Number of intervals to print along the U axis (overrides DELU).

NV: Number of intervals to print along the V axis (overrides DELV).

DELU: Spacing (in GEOM units) of intervals along the U axis.

DELV: Spacing (in GEOM units) of intervals along the V axis.

NOTE: All four entries are not required as input on Card PF; see below for explanation.

OPTIONS

1. $X_{LR} = Y_{LR} = Z_{LR} = 0.$

For this case NU and NV must be specified. In addition, either DELU or DELV must be specified. If the other is left blank, the code will produce an undistorted picture. If both DELU and DELV are specified, the picture will likely be distorted. The standard printers give 10 characters to the inch across a line but only six or eight lines per inch down the page. Because of this, DELV = .6*DELU or .8*DELU is necessary to produce an undistorted picture.

2. X_{LR} or Y_{LR} or $Z_{LR} \neq 0.$

If any one variable on Card PD is specified, the code will calculate the others to produce an undistorted picture.

If both NU and DELU (or both NV and DELV) are specified, DELU (or DELV) will be ignored.

The U and V axes may have arbitrary orientation. (If they are not orthogonal, the resulting picture will be distorted.) In Option 1, the first point will be at $(X,Y,Z)_{UL}$ and the remaining points in the directions and at the distances specified. In Option 2, the range from X_{UL} to X_{LR} is divided into intervals and the calculated points will be at the midpoints of the intervals. The first point will be one-half interval past $(X,Y,Z)_{UL}$ and the final point will be within one-half interval of $(X,Y,Z)_{LR}$. If $(X,Y,Z)_{LR}$ does not lie on the U-V plane, or if the U and V axes are not orthogonal, the location of the final point is not readily predictable.

The simplest method to obtain the correct results is to specify two diagonal corners of the plane of the slice on Card PD, with the top having the short dimension. Then, on Card PE, specify the U axis to be parallel to the edge of the slice with the large dimension (left or right side), and the V axis to be parallel to the edge of the slice with the small dimension (top or bottom). Finally, let the only entry on Card PF be equal to the maximum number of characters per line on your printer; this will provide the largest undistorted picture.

REFERENCES

1. S. K. Fraley, *Users Guide to MORSE-SGC*, ORNL/CSD-7, Oak Ridge National Laboratory (March 1976).

2. D. C. Irving and G. W. Morrison, *PICTURE: An Aid in Debugging Input Data*, ORNL/TM-2892, Oak Ridge National Laboratory (May 1970).

APPENDIX

Sample Description

```
   AMFX MODULE LOG AND LIST OF CARD INPUT DATA

 MODULE SKETCH   HAS BEEN CALLED

   8
   5                cards for SKETCH
.1/*.
  FFCG SIMPLE SAMPLE SOLIDS
 4Z
 SPH 2Z -.5 1
 SPH 2Z .5 1
 RPP -4 4 -4 4 -4 4
 RPP -10 10 -10 10 -10 10
 END
 ZN1 1 -2
 ZN2 2 -1                          cards for FFCG
 ZN3 1 2
 ZN4 3 -1 -2
 ZN5 4 -3
 END
5R1
5Z
 1 2 3 4 0
 0 0  SIMPLE SAMPLE SOLIDS
0.0       2.0       -2.0      0.0       -2.0      2.0
0.0       -1.0      0.0       0.0       0.0       1.0   cards for SKETCH
       130

 MODULE SKETCH   IS FINISHED.
 CPU TIME     1.12 (SECONDS).  I/O'S      91 USER CODE 0000   SYSTEM CODE 000
```

FFCG SIMPLE SAMPLE SOLIDS

IVOPT = 0 IDBG = 0

BODY DATA

SPH	1	0.0		0.0		-0.5000000D 00	0.1000000D 01				
SPH	2	0.0		0.0		0.5000000D 00	0.1000000D 01				
RPP	3	-0.4000000D 01	0.4000000D 01	-0.4000000D 01	0.4000000D 01	-0.4000000D 01	0.4000000D 01				
RPP	4	-0.1000000D 02	0.1000000D 02	-0.1000000D 02	0.1000000D 02	-0.1000000D 02	0.1000000D 02				

NUMBER OF BODIES 4
LENGTH OF FPD-ARRAY 28

INPUT ZONE DATA

	INPUT ZONE	CODE ZONE	BODY NUMBERS		
ZN1	1	1	1	-2	
ZN2	2	2	2	-1	
ZN3	3	3	1	2	
ZN4	4	4	3	-1	-2
ZN5	5	5	4	-3	

NUMBER OF INPUT ZONES 5
NUMBER OF CODE ZONES 5
LENGTH OF INTEGER ARRAY 163

CODE ZONE	INPUT ZONE	ZONE DATA LOC.	NO. OF BODIES	REGION NO.	MEDIA NO.	BOX INPUT ZONE	BOX CODE ZONE
1	1	29	2	1	1	0	0
2	2	40	2	1	2	0	0
3	3	51	2	1	3	0	0
4	4	62	3	1	4	0	0
5	5	78	2	1	0	0	0

I	KR1(I)	KR2(I)
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5

HORSE REGION IN INPUT ZONE(I) ARRAY (NRIZ(I),I=1, 5)

1 1 1 1 1

HORSE MEDIA IN INPUT ZONE(I) ARRAY (MMIZ(I),I=1, 5)

1 2 3 4 0

```
 OPTION 0 WAS USED IN CALCULATING VOLUMES, FOR  1 REGIONS
0-SET VOLUMES = 1, 1-CONCENTRIC SPHERES, 2-SLABS, 3-INPUTVOLUMES.

          VOLUMES ( CC ) USED IN COLLISIONS DENSITY AND TRACK LENGTH ESTIMATORS.
   REG        1
VOLUME  1.00CC 00
```

SIMPLE SAMPLE SOLIDS

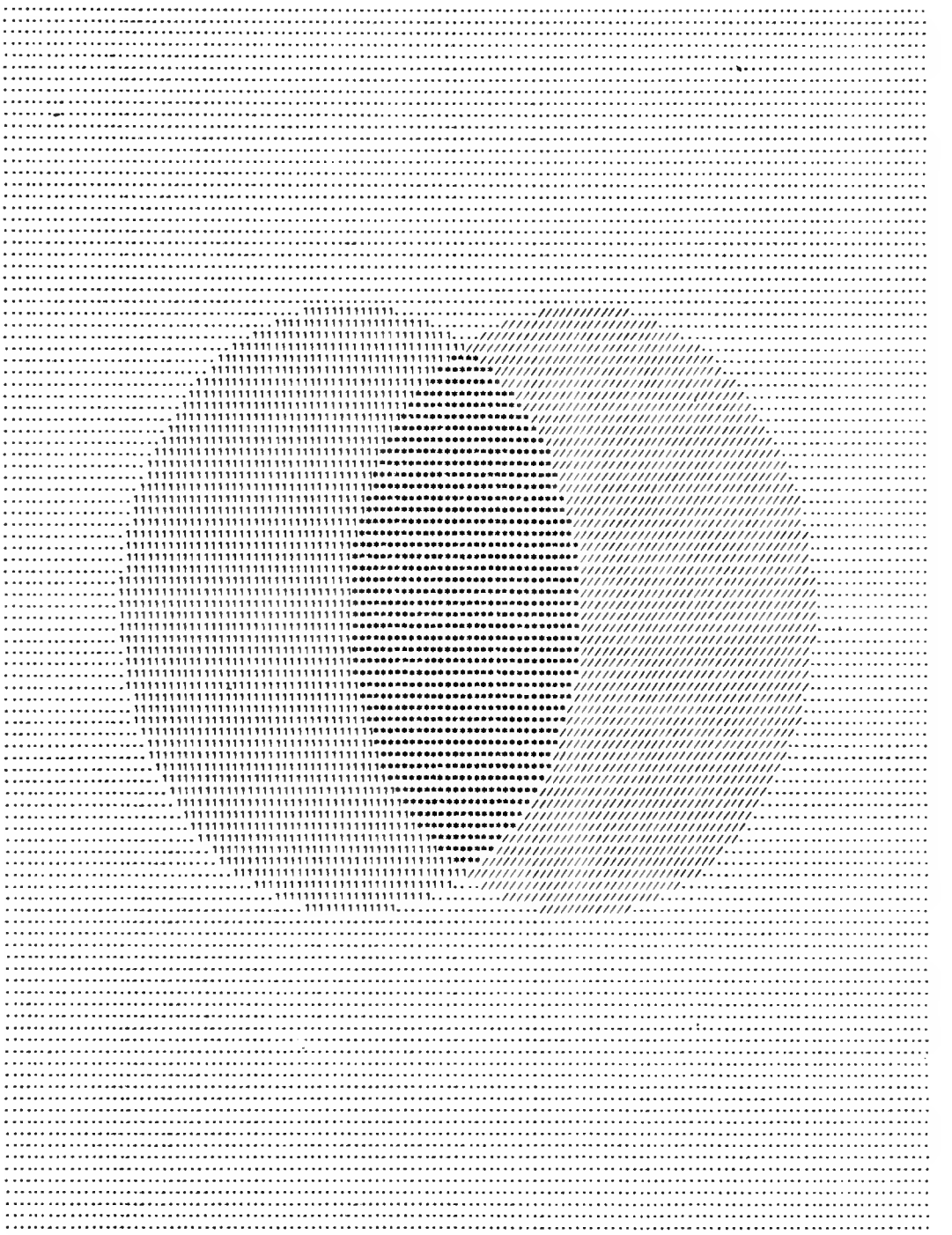
WORDS CORE AVAILABLE= 42496
WORDS CORE USED= 300
ZONE GEOMETRY

MATERIAL GEOMETRY

	UPPER LEFT COORDINATES	LOWER RIGHT COORDINATES
X	0.0	0.0
Y	0.2000E 01	-0.2000E 01
Z	-0.2000E 01	0.2000E 01

	U AXIS (DOWN)	V AXIS (ACROSS)
X	0.0	0.0
Y	-1.00000	0.0
Z	0.0	1.00000

NU= 105 NV= 130 DELU= 0.3846E-01 DELV= 0.3077E-01



```
    AMPX MODULE LOG AND LIST OF CARD INPUT DATA

 MODULE SKETCH   HAS BEEN CALLED

  8
    7
VIETAO
 FFCG TANK SAMPLE PROBLEM
 42
 ARB 1.25 -.125 .5 1.25 -2 0 1.25 2 0 1.25 1.25 .5
-1.25 -1.25 .5 -1.25 -2 0 -1.25 2 0 -1.25 1.25 .5 1234 4158
 6587 2673 5621 4378
  ELL 0 -.5 .5 0 .5 .5 1.5
 TRC 2Z .8 0 2.5 0 .1 .05
ARB 1.25 -2 0 1.25 -1.8 -.8 1.25 2 0 1.25 1.8 -.8
 -1.25 2 0 -1.25 1.8 -.8 -1.25 -2 0 -1.25 -1.8 -.8 1243
 7135 8756 2864 7821 3465
BOX 1.25 -1.979 -.6895 0 .358 .179 0 -.2 .4 -2.5 2Z
   BOX 1.25 1.979 -.6895 0 -.358 .179 0 .2 .4 -2.5 2Z
RCC 1.25 -2 -.2 -2.5 2Z .2
 RCC 1.25 -1.8 -.6 -2.6 2Z .2
 RCC 1.25 2 -.2 -2.5 0 0 .2
   RCC 1.25 1.8 -.6 -2.5 0 0 .2
   RCC 1.25 -.9 -.6 -2.5 0 0 .2
 RCC 1.25 -.45 -.2 -2.5 0 0 .2
   RCC 1.25 0 -.6 -2.5 2Z .2
RCC 1.25 .45 -.2 -2.5 0 0 .2
 RCC 1.25 .9 -.6 -2.5 0 0 .2
 RPP -10 10 -2.5 2.6 -1.5 1.5
 RPP -11 11 -11 11 -11 11
END
 ZN1 1
   ZN2 2 -1
 ZN3 3 -2
 ZN4 4 -7 -8 -9 -10 -11 -12 -13 -14 -15  OR5 -7 -8OR6 -9 -10
   ZN5 7 OR 8 OR 9 OR 10 OR 11 OR 12OR13OR14OR15
ZN6 16 -1 -2 -3 -4 -5 -6 -7 -8 -9 -10
 ZN7 17 -16
 END
 7R1
7Z
 1 2 3 4 5 1000 0
 0 0 FFCG TANK
0.0        -3.0       -2.0       0.0        3.0        2.0
0.0        1.0        0.0        0.0        0.0        1.0
       130

 MODULE SKETCH   IS FINISHED.
 CPU TIME     2.38 (SECONDS).  I/O'S     101 USER CODE 0000   SYSTEM CODE 000
```

PFCG TANK SAMPLE PROBLEM

IVOPT = 0 IDBG = 0

BODY DATA

```
ARB    1  0.1250000D C1 -0.1250000D 00  0.5000000D 00  0.1250000D 01 -0.2000000D 01  0.0
          0.1250000D 01  0.2000000D 01  0.0           0.1250000D 01  0.1250000D 01  0.5000000D 00
         -0.1250000D C1 -0.1250000D 01  0.5000000D 00 -0.1250000D 01 -0.2000000D 01  0.0
         -0.1250000D 01  0.2000000D 01  0.0          -0.1250000D 01  0.1250000D 01  0.5000000D 00
          0.1234000D 04  0.4158000D 04  0.6587000D 04  0.2673000D 04  0.5621000D 04  0.4378000D 04
                        -0.1000000D 01  0.0           0.0           0.1250000D 01
                         0.0            0.0          -0.1000000D 01  0.5000000D 00
                         0.1000000D 01  0.0           0.0           0.1250000D 01
                         0.0            0.0          0.1000000D 01  0.0
                         0.0            0.5547002D 00 -0.8320503D 00  0.1109400D 01
                         0.0           -0.5547002D 00 -0.8320503D 00  0.1109400D 01
                         0.9013878D C0  0.6000000D 01
ELL    2  0.C          -0.5000000D 00  0.5000000D 00  0.0           0.5000000D 00  0.5000000D 00
          0.1500000D 01
TRC    3  0.0           0.0           0.8000000D 00  0.0           0.2500000D 01  0.0
          0.1000000D 00  0.5000000D-01
ARB    4  0.1250000D C1 -0.2000000D 01  0.0           0.1250000D 01 -0.1800000D 01 -0.8000000D 00
          0.1250000D C1  0.2000000D 01  0.0           0.1250000D 01  0.1800000D 01 -0.8000000D 00
         -0.1250000D 01  0.2000000D 01  0.0          -0.1250000D 01  0.1800000D 01 -0.8000000D 00
         -0.1250000D C1 -0.2000000D 01  0.0          -0.1250000D 01 -0.1800000D 01 -0.8000000D 00
          0.1243000D 04  0.7135000D 04  0.8756000D 04  0.2864000D 04  0.7821000D 04  0.3465000D 04
                        -0.1000000D 01  0.0           0.0           0.1250000D 01
                         0.0            0.0          -0.1000000D 01  0.0
                         0.1000000D 01  0.0           0.0           0.1250000D 01
                         0.0            0.0          0.1000000D 01  0.8000000D 00
                         0.0            0.9701425D 00  0.2425356D 00  0.1940285D 01
                         0.0           -0.9701425D 00  0.2425356D 00  0.1940285D 01
                         0.8246211D 00  0.6000000D 01
BCX    5  0.1250000D C1 -0.1979000D 01 -0.6895000D 00  0.0           0.3580000D 00  0.1790000D 00
          0.C           -0.2000000D 00  0.4000000D 00 -0.2500000D 01  0.0           0.0
BCX    6  0.1250000D C1  0.1979000D 01 -0.6895000D 00  0.0          -0.3580000D 00  0.1790000D 00
          0.0            0.2000000D 00  0.4000000D 00 -0.2500000D 01  0.0           0.0
BCC    7  0.1250000D C1 -0.2000000D 01 -0.2000000D 00 -0.2500000D 01  0.0           0.0
          0.2000000D 00
BCC    8  0.1250000D C1 -0.1800000D 01 -0.6000000D 00 -0.2600000D 01  0.0           0.0
          0.2000000D 00
BCC    9  0.1250000D C1  0.2000000D 01 -0.2000000D 00 -0.2500000D 01  0.0           0.0
          0.2000000D C0
BCC   10  0.1250000D 01  0.1800000D 01 -0.6000000D 00 -0.2500000D 01  0.0           0.0
          0.2000000D 00
BCC   11  0.1250000D 01 -0.9000000D 00 -0.6000000D 00 -0.2500000D 01  0.0           0.0
          0.2000000D 00
BCC   12  0.1250000D C1 -0.4500000D 00 -0.2000000D 00 -0.2500000D 01  0.0           0.0
          0.2000000D 00
BCC   13  0.1250000D C1  0.0          -0.6000000D 00 -0.2500000D 01  0.0           0.0
          0.2000000D 00
BCC   14  0.1250000D 01  0.4500000D 00 -0.2000000D 00 -0.2500000D 01  0.0           0.0
          0.2000000D 00
```

```
RCC    15  0.1250000D C1  0.9000000D 00 -0.6000000D 00 -0.2500000D 01  0.0            0.0
           0.2000000D 00
RPP    16 -0.1000000D 02  0.1000000D 02 -0.2500000D 01  0.2600000D 01 -0.1500000D 01  0.1500000D 01

RPP    17 -0.1100000D 02  0.1100000D 02 -0.1100000D 02  0.1100000D 02 -0.1100000D 02  0.1100000D 02


NUMBER OF BODIES      17
LENGTH OF RPD-ARRAY  208
```

INPUT ZONE DATA

	INPUT ZONE	CODE ZONE		BODY NUMBERS								
ZN1	1	1		1								
ZN2	2	2		2	-1							
ZN3	3	3		3	-2							
ZN4	4	4		4	-7	-8	-9	-10	-11	-12	-13	-14
				-15								
		5	OR	5	-7	-8						
		6	CR	6	-9	-10						
ZN5	5	7		7								
		8	OR	8								
		9	OR	9								
		10	OR	10								
		11	OR	11								
		12	OR	12								
		13	OR	13								
		14	OR	14								
		15	CR	15								
ZN6	6	16		16	-1	-2	-3	-4	-5	-6	-7	-8
				-9	-10							
ZN7	7	17		17	-16							

```
NUMBER OF INPUT ZONES      7
NUMBER OF  CODE ZONES     17
LENGTH OF INTEGER ARRAY  456
```

CODE ZONE	INPUT ZONE	ZONE DATA LOC.	NO. OF BODIES	REGION NO.	MEDIA NO.	BOX INPUT ZONE	BOX CODE ZONE
1	1	120	1	1	1	0	0
2	2	126	2	1	2	0	0
3	3	137	2	1	3	0	0
4	4	148	10	1	4	0	0
5	4	199	3	1	4	0	0
6	4	215	3	1	4	0	0
7	5	231	1	1	5	0	0
8	5	237	1	1	5	0	0
9	5	243	1	1	5	0	0
10	5	249	1	1	5	0	0
11	5	255	1	1	5	0	0
12	5	261	1	1	5	0	0
13	5	267	1	1	5	0	0
14	5	273	1	1	5	0	0
15	5	279	1	1	5	0	0
16	6	285	11	1	1000	0	0
17	7	341	2	1	0	0	0

I	KR1(I)	KR2(I)
1	1	1
2	2	2
3	3	3
4	4	6
5	7	15
6	16	16
7	17	17

MORSE REGION IN INPUT ZONE(I) ARRAY (MRIZ(I),I=1, 7)

1 1 1 1 1 1 1

MORSE MEDIA IN INPUT ZONE(I) ARRAY (MMIZ(I),I=1, 7)

1 2 3 4 5 1000 0

OPTION 0 WAS USED IN CALCULATING VOLUMES, FOR 1 REGIONS
0-SET VOLUMES = 1, 1-CONCENTRIC SPHERES, 2-SLABS, 3-INPUTVOLUMES.

VOLUMES (CC) USED IN COLLISIONS DENSITY AND TRACK LENGTH ESTIMATORS.

REG	1
VOLUME	1.000E 00

FPCG TANK

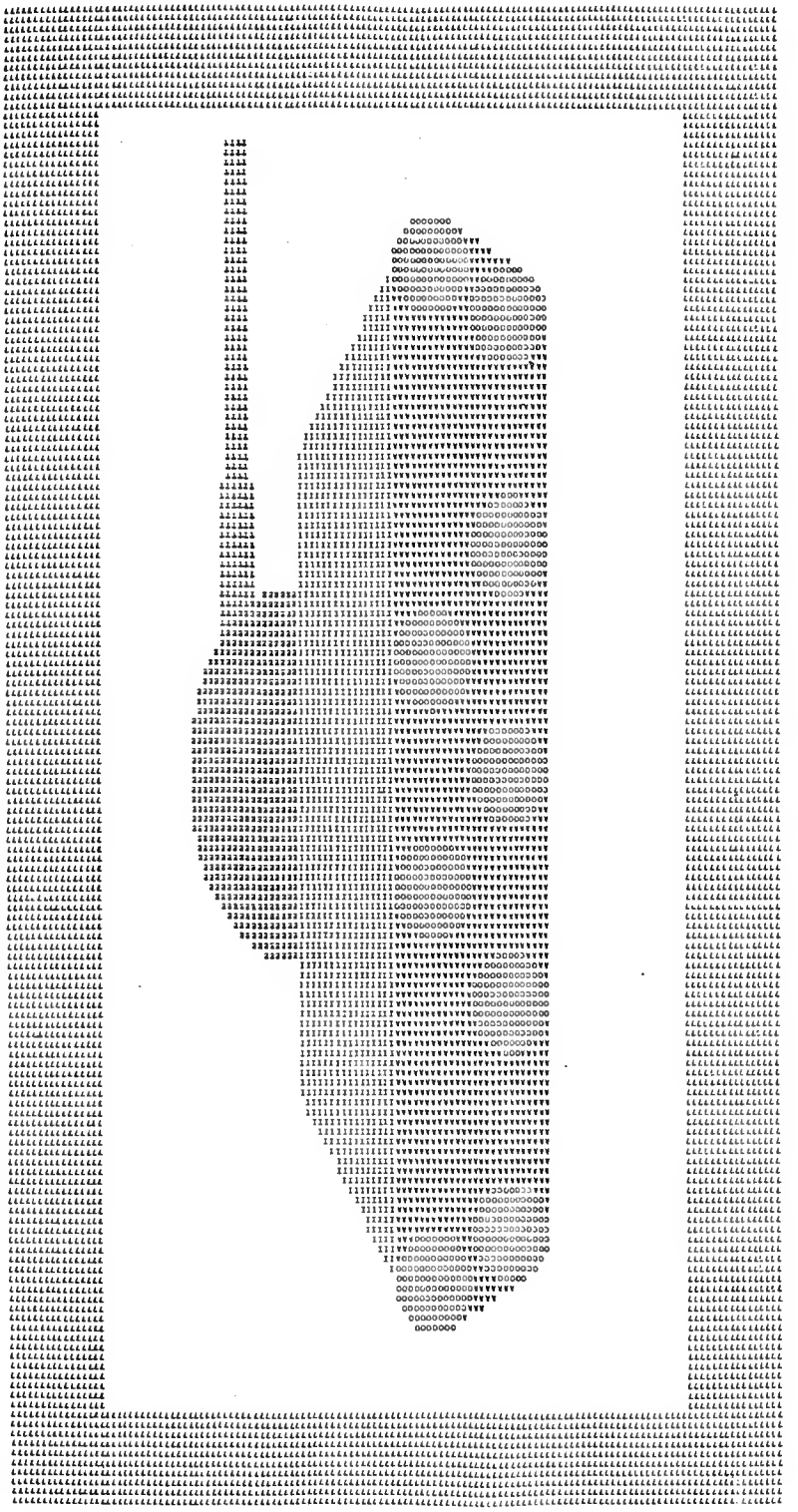
WORDS CORE AVAILABLE= 42496
WORDS CORE USED= 1043
ZONE GEOMETRY

MATERIAL GEOMETRY

	UPPER LEFT COORDINATES	LOWER RIGHT COORDINATES
X	0.0	0.0
Y	-0.3000E 01	0.3000E 01
Z	-0.2000E 01	0.2000E 01

	U AXIS (DOWN)	V AXIS (ACROSS)
X	0.0	0.0
Y	1.00000	0.0
Z	0.0	1.00000

NU= 157 NV= 130 DELU= 0.3846E-01 DELV= 0.3077E-01



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