組み合わせジオメトリーCGの使い方

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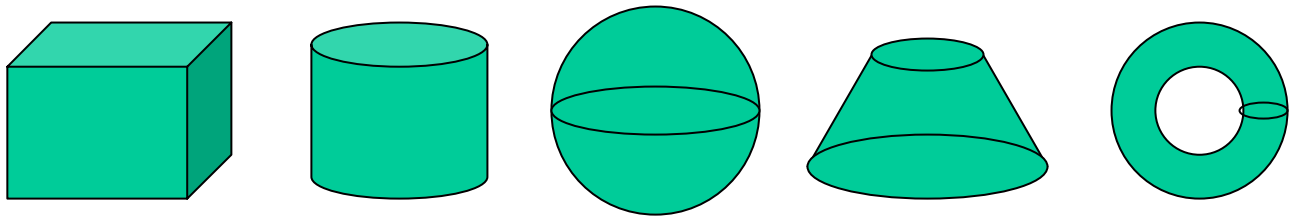
テキスト：naicgv.pdfおよびphantomcgv.pdfの1-3ページ

CG(Combinatorial Geometry)体系

- 利点：複雑な体系を比較的少ない労力で記述可能
- 形状定義：SOLID（中身のある物体）で表現
- 領域定義：形状の組み合わせ（論理演算）で記述
  - 一番外側はDiscard領域
- 14種類の形状

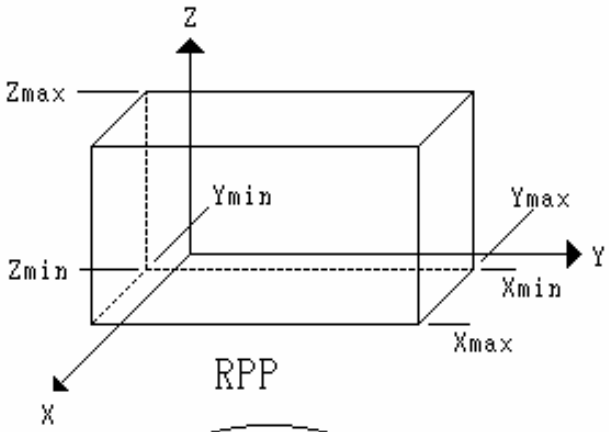


直方体（RPP） 円柱（RCC） 球（SPH） 円錐台（TRC） トーラス（TOR）

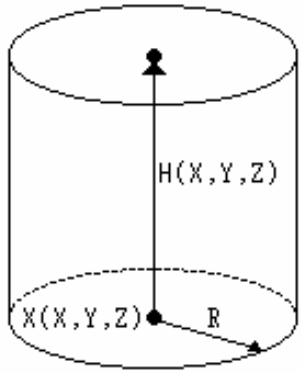
上記5種類はEGS4でも対応

平行六面体 楕円柱、楕円錐、楕円球、くさび型、平面、多面体、六角柱、一般楕円体(Cgview 2.1.0以降のマニュアル参照)

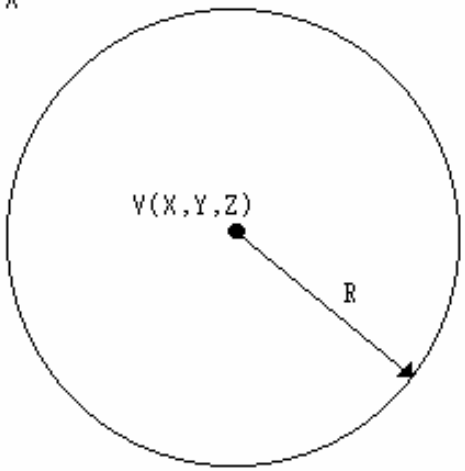
各形状の入力パラメータ



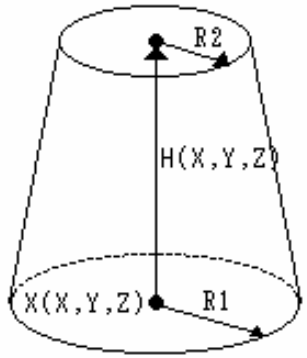
RPP



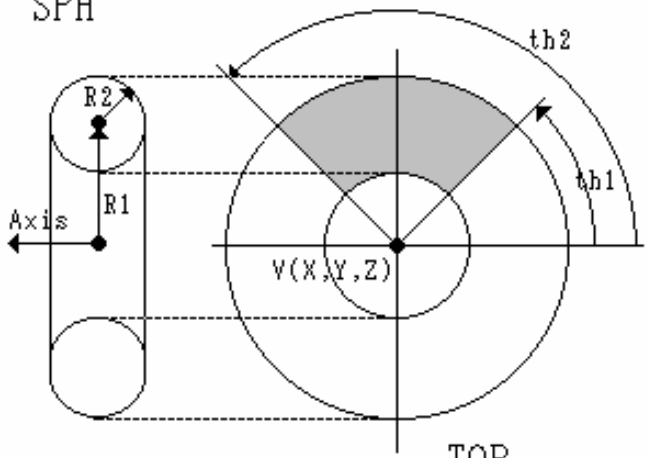
RCC



SPH



TRC



TOR

記述順序

- RPP No. X_{min} X_{max} Y_{min} Y_{max} Z_{min} Z_{max}
- SPH No. V_x V_y V_z R
- RCC No. V_x V_y V_z H_x H_y H_z R
- TRC No. V_x V_y V_z H_x H_y H_z R_1 R_2
- TOR No. V_x V_y V_z R_1 R_2 θ_1 θ_2 n

ジオメトリ入力の簡略化

CG→

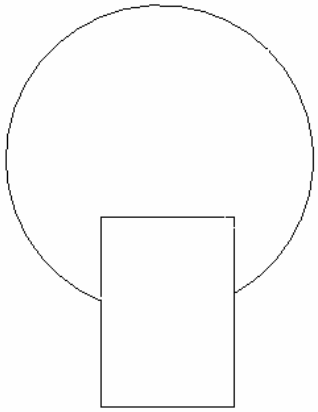
```
RCC   1      0      0      0      0      0      30      10
RCC   2      0      0      0.1    0      0      29.8    9.9
RCC   3      0      0      5      0      0      15      5
RCC   4      0      0      5.1    0      0      14.9    4.9
END
 Z1     1
 Z2     2    -1
 Z3     3    -2
 Z4     4    -3
END
```

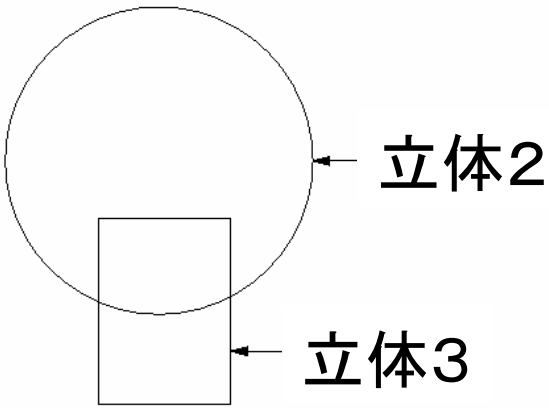
←円筒平板→
(EGS4)

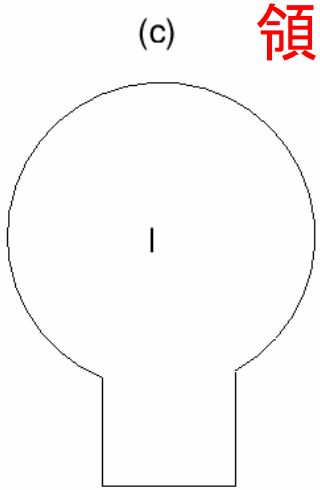
```
"DEFINE VARIOUS THICKNESSES/DISTANCES"

TCOV=0.1;   "Thickness of Al case in cm "
TGAP=0.5;   "Gap between case and detector in cm"
TDE=7.62;   "Thickness of detector in cm"
TQUARTZ=0.5;"Thickness of quartz window in cm

"DEFINITION OF PLANES"

"SET ALL COORDINATES AND NORMALS TO ZERO TO BEGIN WITH"
DO J=1,NPLAN [
  PCOORD(1,J)=0.0;  PCOORD(2,J)=0.0;  PCOORD(3,J)=0.0;
  PNORM(1,J)=0.0;   PNORM(2,J)=0.0;   PNORM(3,J)=1.0;
]

"NOW PUT IN THE EXCEPTIONS"

PCOORD(3,2)=PCOORD(3,1)+TCOV;
PCOORD(3,3)=PCOORD(3,2)+TGAP;
PCOORD(3,4)=PCOORD(3,3)+TDE;
PCOORD(3,5)=PCOORD(3,4)+TQUARTZ;

OUTPUT; ('1PCOORD AND PNORM VALUES FOR EACH J-PLANE
(I=1,3):',//);
DO J=1,NPLAN [
OUTPUT J,(PCOORD(I,J),I=1,3),(PNORM(I,J),I=1,3);
(I5,6G15.7);]

"DEFINE THE CYLINDER RADII"

RDET=3.81;  "Radius of detector in cm"
RGAP=0.5;   "Gap between detector and case in cm"
RTCOV=0.1;  "Cover thickness in cm"

CYRAD(1)=RDET;
CYRAD(2)=CYRAD(1)+RGAP;
CYRAD(3)=CYRAD(2)+RTCOV;
```

```
"*************************************************************"
"                    STANFORD LINEAR ACCELERATOR CENTER"
SUBROUTINE HOWFAR;
"                    EGS4 SUBPROGRAM -  8 MAY 1983/1730"
"*************************************************************"
;COMIN/DEBUG,EPCONT,GEOM,PASSIT,STACK,THRESH/;

IRL=IR(NP);  "SET LOCAL VARIABLE"

IF(IRL.LE.1.OR.IRL.GE.IRZ+2) [IDISC=1; RETURN;]

NSLAB=(IRL-2)/NCYL + 1 ; "SLAB NUMBER"
NANNU=IRL-1-NCYL*(NSLAB-1); "ANNULUS NUMBER"
NPL1=NSLAB+1; NPL2=NSLAB;
IF(NSLAB.LT.NPLAN-1) [NRG1=IRL+NCYL;]
ELSE [NRG1=IRZ+2;]
IF(NSLAB.GT.1) [NRG2=IRL-NCYL;]
ELSE [NRG2=1;]

$PLAN2P(NPL1,NRG1,1,NPL2,NRG2,-1);

IF(NANNU.LT.NCYL) [NRG2=IRL+1;]
ELSE [NRG2=IRZ+3;]
IF(NANNU.GT.1) [NRG1=IRL-1; NCL2=NANNU;
NCL1=NANNU-1;
$CYL2(NCL1,NRG1,NCL2,NRG2); RETURN;]

$CYLNDR(1,1,IHIT,TCYL);
IF(IHIT.EQ.1) [
$CHGTR(TCYL,NRG2);]

RETURN;
END;  "END OF SUBROUTINE HOWFAR"
```

単独の立体では不便…
←こんな体系で計算したい

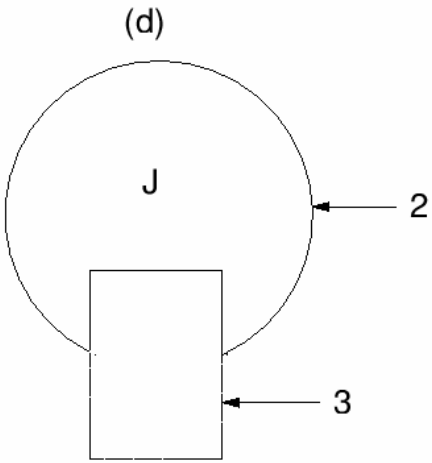


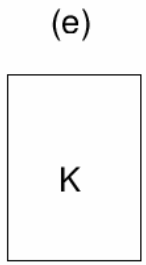




領域I=+2 OR +3　論理和

立体の組み合わせで空間を指定して、「領域」、「リージョン」、「ゾーン」と呼ぶ。
＋－でそれぞれ立体の内側と外側を示す。



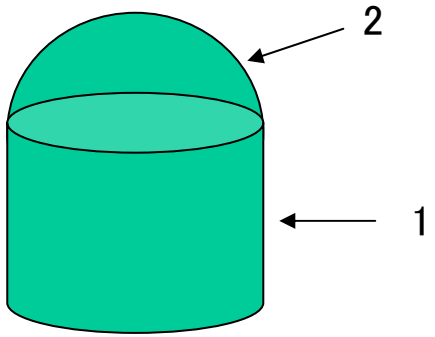


ゾーンK=+3

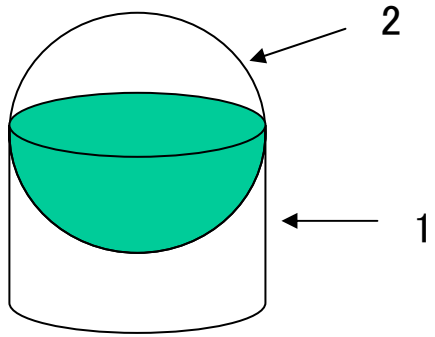
リージョンJ=+2 -3　論理差

CG体系での論理演算の例

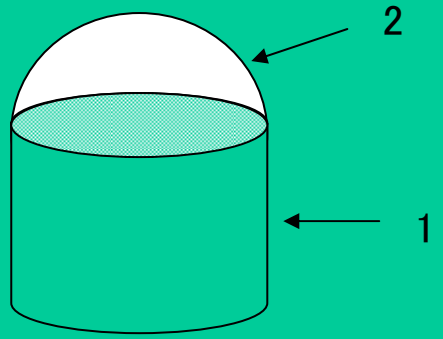
論理和：1 OR 2



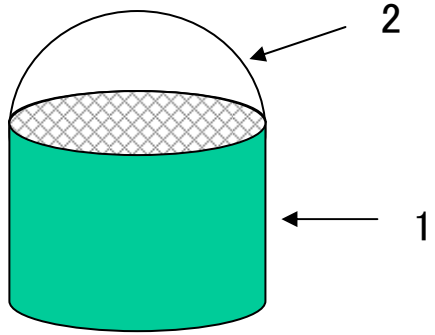
論理積：1　2



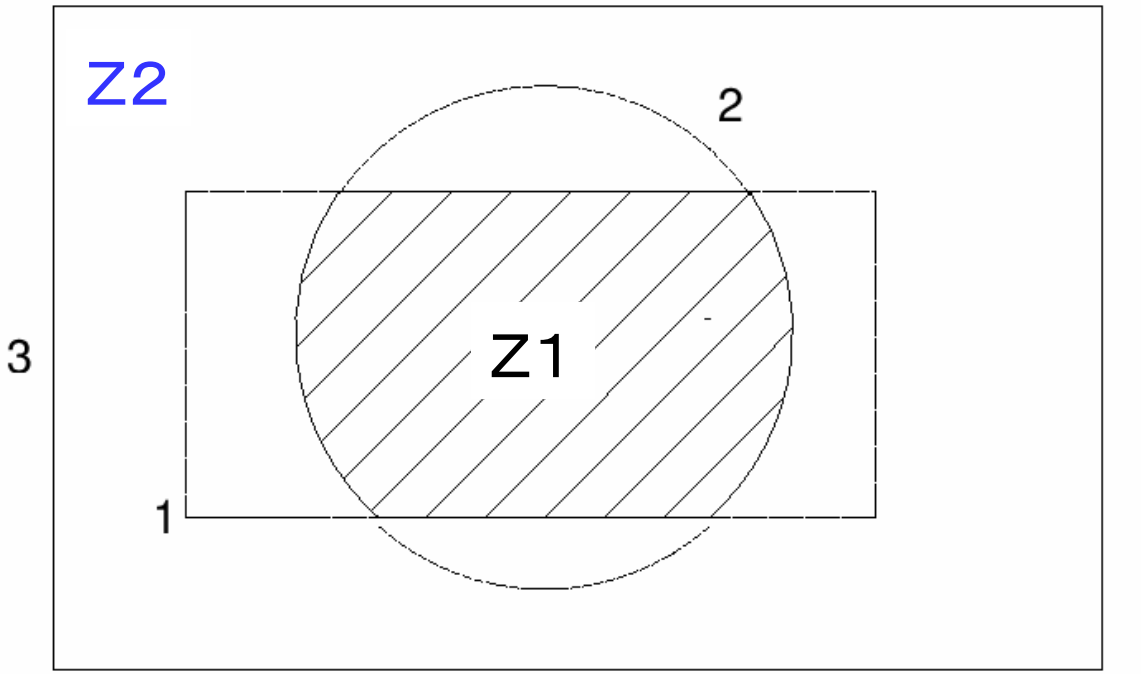
否定と論理和：1　OR −2



否定と論理積：1　−2



論理演算の組み合わせ例

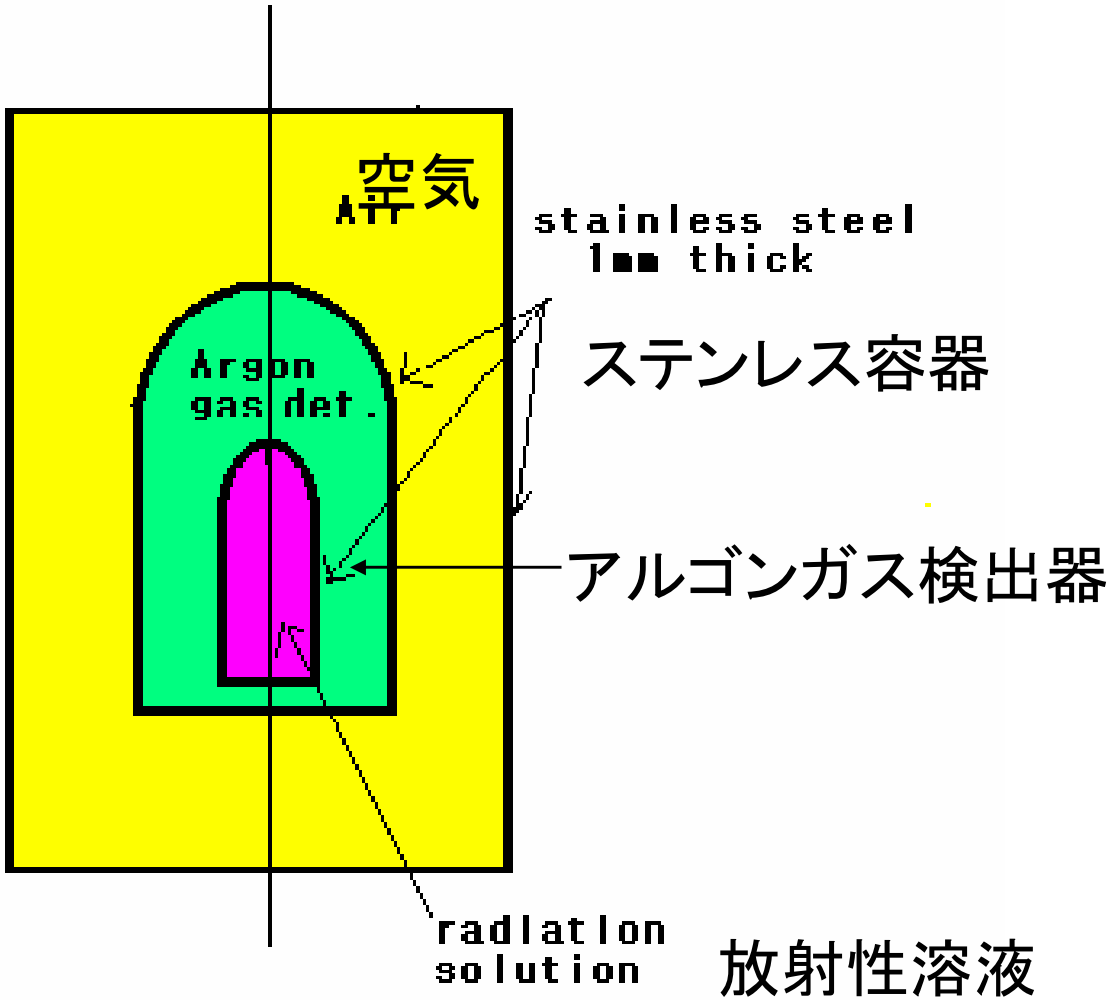


Z2　+3 –1 OR +3 –2 :

立体3の内側で立体1の外側、または、

立体3の 内側で立体2の外側の空間

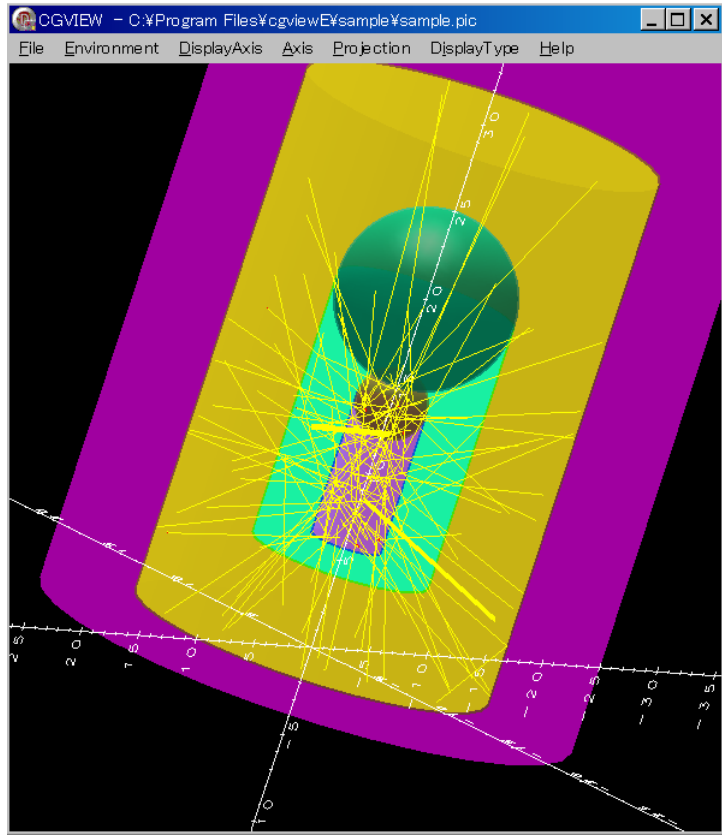
複雑なCG体系の例



ステンレス容器

アルゴンガス検出器

放射性溶液



cylindrical detectors
having regions
particially spherical

半球＋円柱形状検出器

立体の入力

```
RCC    1 0.0      0.0      0.0      0.0      0.0    30.0      10.0
 RCC    2 0.0      0.0      0.1      0.0      0.0    29.8      9.9
 RCC    3 0.0      0.0      5.0      0.0      0.0    15.0      5.0
 RCC    4 0.0      0.0      5.1      0.0      0.0    14.9      4.9
 RCC    5 0.0      0.0      6.0      0.0      0.0    8.0       2.0
 RCC    6 0.0      0.0      6.1      0.0      0.0    7.9       1.9
 SPH    7 0.0      0.0      14.0     1.9
 SPH    8 0.0      0.0      14.0     2.0
 SPH    9 0.0      0.0      20.0     4.9
 SPH   10 0.0      0.0      20.0     5.0
 RCC   11 0.0      0.0      -1.0     0.0      0.0    40.0      15.0
 END
```

Z1 **+6 OR +7**

Z2 **+5 -6 OR +8 -7 -5**

Z3 **+4 -5 -8 OR +9 -4**

Z4 **+3 -4 OR +10 -9 -3**

Z5 **+2 -3 -10**

Z6 **+1 -2**

Z7 **+11 -1**

END

← １ 放射性溶液

← ２ SUS容器

← ３ アルゴン検出器

← ４ SUS容器

← ５ 空気

← ６ SUS容器

← 追跡終了領域