2017.10.01

ディジタル信号処理と画像処理（CG 編）

レンダリング演習

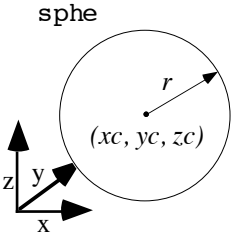
http://home.hiroshima-u.ac.jp/kin/class/dspip/

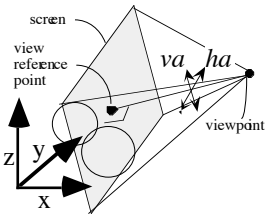
1. 入力データフォーマット (Input data format)

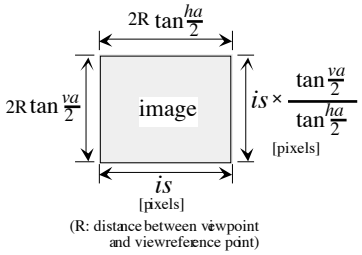
Sphere:	`sphe`	*xc*	*yc*	*zc*	*r*			
Material (opaque):	`opaq`	*dR*	*dG*	*dB*	*ks*	β		(Level 1)
Material (mirror):	`mirr`							(Level 2)
Material (transparent):	`trpa`	*kt*	*n*	*ks*	β			(Level 3)
Material (mapping):	`tmap`	(*texture*)						(Level 4)
Light (directional light):	`dlig`	*lx*	*ly*	*lz*	*LR*	*LG*	*LB*	
Background:	`back`	*BR*	*BG*	*BB*				
Ambient light:	`elig`	*ke*						
Viewpoint:	`eyep`	*xv*	*yv*	*zv*				
View reference point:	`refp`	*xf*	*yf*	*zf*				
View angle:	`vang`	*ha*	*va*					
Image resolution:	`size`	*is*						
Rendering:	`rend`	(*filename*)						
Quit:	`quit`							

パラメータ (Parameters in the data format)

xc, *yc*, *zc*, *r*:	center, (*xc*, *yc*, *zc*), and radius, *r*, of sphere
dR, *dG*, *dB*:	diffuse-reflection coefficient ($0 \le dR, dG, dB \le 1$)
ks:	specular-reflection coefficient ($0 \le ks \le 1$)
β:	specular-reflection exponent ($\beta \ge 1$ (integer))
kt:	transmission coefficient ($0 \le kt \le 1$)
n:	index of refraction ($n \ge 1$)
texture:	texture (file name)
lx, *ly*, *lz*:	light direction vector
LR, *LG*, *LB*:	intensity of light ($0 \le LR, LG, LB (\le 255)$)
BR, *BG*, *BB*:	background color ($0 \le BR, BG, BB \le 255$)
ke:	ambient-reflection coefficient ($0 \le ke \le 1$)
xv, *yv*, *zv*:	viewpoint
xf, *yf*, *zf*:	view reference point
ha, *va*:	horizontal and vertical view angles [degree]
filename:	output file name (image file)



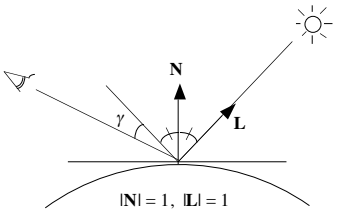




2. シェーディング (Shading)

・opaque object:
$$I_\lambda = \begin{cases} (ke+(1-ke)(\mathbf{N}\bullet\mathbf{L}))d_\lambda L_\lambda + ksL_\lambda \cos^\beta \gamma & if\ (\mathbf{N}\bullet\mathbf{L})>0, \cos\gamma>0 \\ (ke+(1-ke)(\mathbf{N}\bullet\mathbf{L}))d_\lambda L_\lambda & if\ (\mathbf{N}\bullet\mathbf{L})>0, \cos\gamma\le 0 \\ ked_\lambda L_\lambda & \text{otherwise} \end{cases}$$

・transparent object:
$$I_\lambda = \begin{cases} ksL_\lambda \cos^\beta \gamma + ktT_\lambda & if\ (\mathbf{N}\bullet\mathbf{L})>0, \cos\gamma>0 \\ ktT_\lambda & \text{otherwise} \end{cases}$$



・object with mirror reflection:
$$I_\lambda = R_\lambda$$

$(\lambda = R,G,B)$, (T_λ: transmitted light, R_λ: reflected light)

3. 光線追跡法 (Ray tracing algorithm)

4. サンプルデータ(データ 3)と表示結果画像 (Sample data (Data 3) and the output image)

```
####### ex2s3.dat #######
sphe    0.    0.    0.   20.
opaq    1.    1.    0.   0.2   10
sphe    0.   50.    0.   18.
opaq    1.  0.2   0.5   0.4   20
sphe   30.  -20.   30.   30.
opaq   0.2    1.   0.8   0.3   30
sphe   20.   20.   25.   12.
mirr
sphe   40.   40.    0.   15.
trpa   0.8   1.5   0.2   10
sphe    0.   50.   40.   10.
trpa   0.8   2.42   0.2   10
sphe   40.   80.   30.   14.
trpa   0.9   1.7   0.1   20
sphe   60.  -10.  -20.   25.
mirr
back    0.    0.  128.
dlig   0.5   0.5   2.  255.  255.  255.
elig   0.2
eyep   100.  150.   80.
refp    0.    0.    0.
vang   40.   30.5
size   640
rend   ex2s3
quit
```