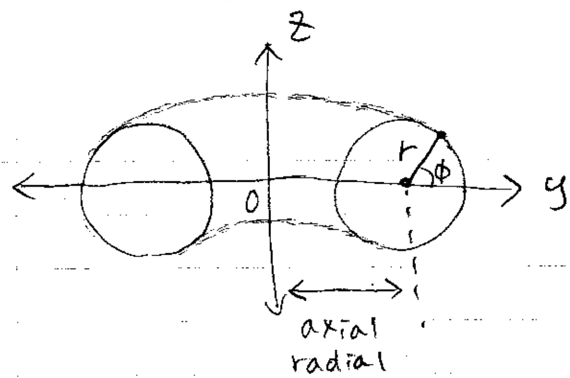
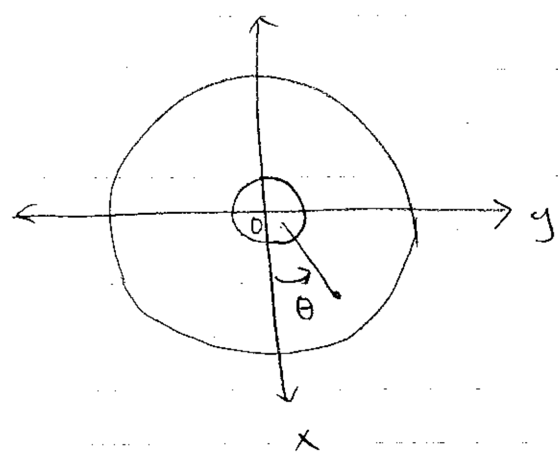
① Parametric equation for a torus

Center = (0, 0)
radius = 2
axial radial = 6

$$x = (6 + 2\cos\phi)\cos\theta, \quad -\pi \le \phi \le \pi$$
$$y = (6 + 2\cos\phi)\sin\theta, \quad -\pi \le \theta \le \pi$$
$$z = 2\sin\phi$$





(2) radius = 3; longitude = latitude = 10;
height = 5;

```
GLUquadricObj *cylinder;
cylinder = gluNewQuadric();
gluQuadricDrawStyle(cylinder, GLU_LINE);
gluCylinder(cylinder, 3, 3, 5, 10, 10);
```

GABRIEL LADEN
JOSH

3.)

GAUSSIAN DENSITY FUNCTION　　P. 418

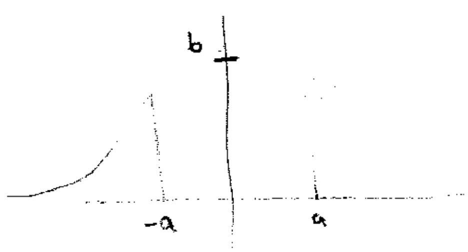
- ONE METHOD FOR MODELING BLOBBY OBJECTS.
- SURFACE FUNCTION $f(x,y,z) = \sum_k b_k e^{-a_k r_k^2} - T = 0$

where $r_k^2 = x_k^2 + y_k^2 + z_k^2$

T = threshold, (how tight curve fits)

a_k, b_k = adjust blobbiness

* negative values of b_k create dents



GAUSSIAN

COMPOSITE GAUSSIAN

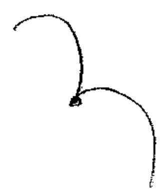
EXAMPLE USE: YOU CAN MODEL THE SURFACE STRUCTURE OF A COMPOSITE OBJECT BY USING SEVERAL GAUSSIAN DENSITY FUNCTIONS.

GABRIEL LADEN

Josh

4.)

EXAMPLE CURVE



DEF. C^0 continuity = curves meet at point

G^1 continuity = first derivatives are proportional

若紫雲

Brian McCloud

5. $(0,0,0)(2u^3-3u^2+1)+(1,2,3)(-2u^3+3u^2)$
$+(1,0,0)(u^3-2u^2+u)+(0,0,1)(u^3-u^2)$

$x(u)=-u^3+u^2+u$
$y(u)=-4u^3+6u^2$
$z(u)=-5u^3+8u^2$

6. tension is $\emptyset$

James Wong
Kristian

Problem 7

$BEZ_{3,5}(u) \qquad BEZ_{k,n}(u) = C(n,k)\, u^k (1-u)^{n-k}$

$$\begin{aligned} BEZ_{3,5}(u) &= C(5,3)\, u^3 (1-u)^{5-3} \\ &= \frac{5!}{3!(5-3)!} u^3 (1-u)^2 \\ &= \frac{5 \cdot 4 \cdot \cancel{3!}}{\cancel{3!} \cdot 2!} u^3 (1-u)^2 \\ &= 10 u^3 (1-u)^2 \end{aligned}$$

Problem 8

$$M_B^{-1} M_H \begin{bmatrix} P_0 \\ P_1 \\ DP_0 \\ DP_1 \end{bmatrix} \qquad M_B = \frac{1}{6}\begin{bmatrix} -1 & 3 & -3 & 1 \\ 3 & -6 & 3 & 0 \\ -3 & 0 & 3 & 0 \\ 1 & 4 & 1 & 0 \end{bmatrix}$$

1. Find inverse of M_B

$$M_B \quad \frac{1}{6}\begin{bmatrix} -1 & 3 & -3 & 1 \\ 3 & -6 & 3 & 0 \\ -3 & 0 & 3 & 0 \\ 1 & 4 & 1 & 0 \end{bmatrix}\begin{bmatrix} x_1 & x_2 & x_3 & x_4 \\ y_1 & y_2 & y_3 & y_4 \\ z_1 & z_2 & z_3 & z_4 \\ w_1 & w_2 & w_3 & w_4 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

2. Multiply $M_B^{-1} M_H \begin{bmatrix} P_0 \\ P_1 \\ DP_0 \\ DP_1 \end{bmatrix}$ to find control points.

Now a 1pt bonus problem.
Use fact that if B-spline is cubic and has
Knots $\{0, 1, 2, 3, 4, 5, 6, 7\}$ then:

$P(0) = \frac{1}{6}(\vec{P}_0 + 4\vec{P}_1 + \vec{P}_2)$

$P(1) = \frac{1}{6}(\vec{P}_1 + 4\vec{P}_2 + \vec{P}_3)$

$P'(0) = \frac{1}{2}(\vec{P}_2 - \vec{P}_0)$

$P'(1) = \frac{1}{2}(\vec{P}_3 - \vec{P}_1)$

from statement of Problem 5 have:

$P(0) = (0,0,0)$
$P(1) = (1,2,3)$
$P'(0) = (1,0,0)$
$P'(1) = (0$

9

```
GLUnurbsObj *surfname;
surfName = gluNewNurbsRenderer();
// Then set whatever properties of spline want with:
gluNurbProperty(surfName, property1, value1);
    ⋮

gluBeginSurface(surfName);
    gluNurbSurface(surface, uKnots, uKnotVector,
        vKnots, vKnotVector, uStride, vStride,
        &ctrlPts[0][0][0], uDegParam, vDegParam,
        GL_MAP2_VERTEX3);
gluEndSurface(surfName);
```

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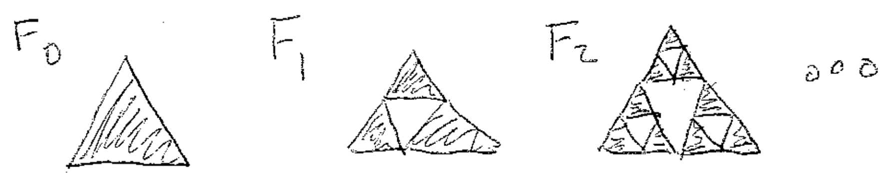

Formula

n - number of pieces similar to previous figure (3 in this case)

s - scale factor applied to these feature ($\frac{1}{2}$ in this case)

$$D = \frac{\ln n}{\ln \frac{1}{s}} = \frac{\ln 3}{\ln 2} = 1.58$$