Tut 8

Qn 1

A texture pattern whose extent is given by

$0 \le s \le 1 \qquad 0 \le t \le 1$

is to be mapped to a cylinder with axis

X = 3 Y = 5

and radius 3. The top and bottom of the cylinder is given by Z = ± 4. Suppose the mapping is such that s maps to θ and t maps to z, such that

s = 0 maps to $\theta = 0$ s = 1 maps to $\theta = 2\pi$

t = 0 maps to Z = -4 t = 1 maps to Z = +4

Further assume that the mapping is linear.

a) Calculate the texture-to-surface transformation, i.e. the transformation from (s, t) to (θ, z).

b) Suppose the cylinder is rotated about y by +30° and then parallel project with a projection vector of (1, 1, -2) to the (x, y) image plane. Calculate the MODELVIEW transformation matrix and projection transformation matrix.

c) Hence give an expression for image space to texture space transformation i.e., the transformation from (x, y) to (s, t).

d) What is the advantage of pixel order scanning compared with texture scanning?

e) The method in c) is complicated because it involves inverse transformation and thus it is impractical. Suggest a simpler method to implement pixel order scanning.

Qn 2

The parametric equation of a ball is

$X = 5(cos\alpha)(cos\beta) + 10$
$Y = 5(sin\alpha)(cos\beta) + 50$
$Z = 5(sin\beta)$

A logo is mapped to the surface of the ball such that

$(s, t) = (0, 0)$ maps to $(\alpha, \beta) = (0, 0)$
$(s, t) = (1, 0)$ maps to $(\alpha, \beta) = (\pi/2, 0)$
$(s, t) = (1, 1)$ maps to $(\alpha, \beta) = (\pi/4, \pi/4)$

Derive the texture $(s, t) \rightarrow$ surface (α, β) transformation.

OpenGL Mini-project Progress

Now you should program texture into your scene. Start with a flat plane, which is the simplest. Then proceed to more exotic objects if you have time.