Solutions

Texture Mapping Practice

Texture Mapping a Cone

When texture mapping a cone, there are several ways one could "unwrap" the cone onto the texture. Here, we'll imagine that the entire top line of the texture ($v = 1$) is mapped to the tip of the cone, and the bottom line of the texture ($v = 0$) is mapped to the bottom rim of the cone. For a cone with height h and radius r, create a texture mapping method that will map each point (x, y, z) on the surface (not the base) of the cone to a point (u, v) on a rectangular texture.
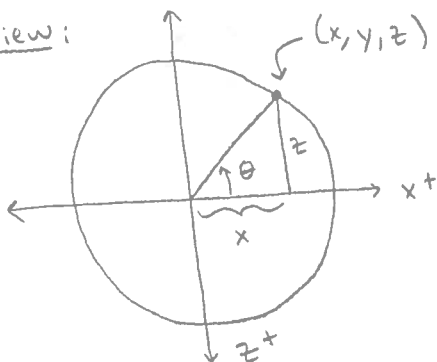

determine v
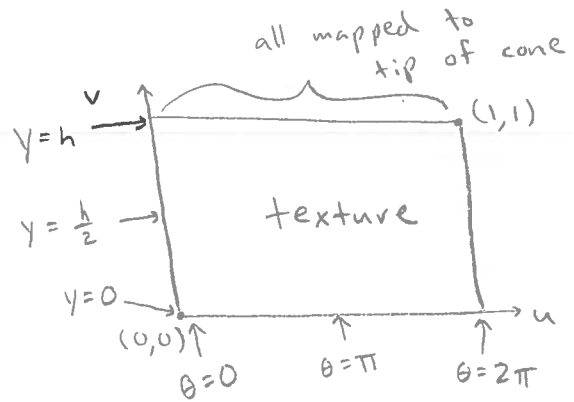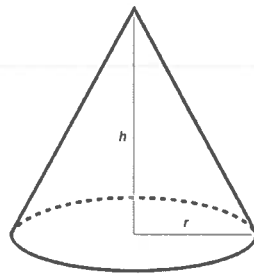
Front view:
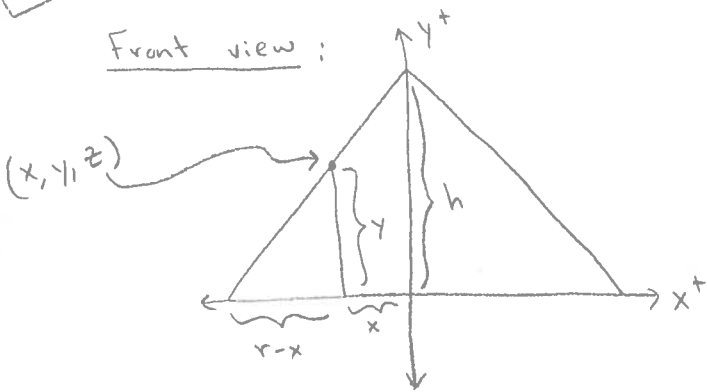
ratio of hypotenuse of smaller triangle to hypotenuse of larger triangle; is the same as $y : h$, is the same as $\boxed{v}$.

$$\Rightarrow \quad \frac{\sqrt{(r-x)^2 + y^2}}{\sqrt{h^2 + r^2}} = \frac{y}{h} = v \qquad \Rightarrow \qquad \boxed{v = \frac{y}{h}}$$

To use the whole texture, $u = \dfrac{\theta}{2\pi}$

$\Rightarrow$ find θ.

determine u

Top view:

$$\tan\theta = \frac{o}{a} = \frac{z}{x} \qquad \Rightarrow \qquad \theta = \tan^{-1}\left(\frac{z}{x}\right)$$

$$\Rightarrow \quad \boxed{u = \frac{\tan^{-1}\left(\frac{z}{x}\right)}{2\pi}}$$