Math 203 Matlab Final

NAME: 05/11/2018

The cooling towers of many nuclear power plants are designed in the shape of an elliptic hyperboloid (hyperboloid of one sheet).

Figure 1: Nuclear Cooling Towers

Imagine that a certain plant uses cooling towers that are 00 feet in total height, with a radius of roughly $\sqrt{500}$ feet. The equation for the surface of the cooling towe8 can be described as:

$$\frac{x^2}{500} + \frac{y^2}{500} - \frac{z^2}{2000} = 1, \text{ for } -65 \leq z \leq 15$$

1

Using Matlab's **ezsurf()** function and the following parameterization produce a plot of the cooling tower.

$$x(u,t) = 10\sqrt{5}(\cos t + u \sin t)$$

$$y(u,t) = 10\sqrt{5}(\sin t - u \cos t)$$

$$z(u,t) = 20\sqrt{5}u$$

$$t \in [0, 2\pi] \text{ and } u \in \left[\frac{-13}{4\sqrt{5}}, \frac{3}{4\sqrt{5}}\right]$$

2

The actual cooling towers are not two-dimensional surfaces, but rather 3d solids. Imagine that the tower can be modeled as being the region between two hyberoloids.

$$H_1 : \frac{x^2}{500} + \frac{y^2}{500} - \frac{z^2}{2000} = 1, \text{ for } -65 \leq z \leq 15$$

and

$$H_2 : \frac{x^2}{415} + \frac{y^2}{415} - \frac{z^2}{2000} = 1, \text{ for } -65 \leq z \leq 15$$

Where the tower is inside H_1 and outside H_2. By using cylindrical coordinates the tower becomes the (graph-type) region in space described by:

$$-65 \leq z \leq 15$$

$$0 \leq \theta \leq 2\pi$$

$$\sqrt{450 + \frac{9z^2}{40}} \leq r \leq \sqrt{500 + \frac{z^2}{4}}$$

Use Matlab to compute the volume of this region (as a triple integral), give your answer to two decimal places. (Don't forget to multiply by 2!)