

COMPUTER PROJECT 10

Möbius Strips

DUE: 05/24/2022

Instructions: Use *Mathematica* to solve the following problems. Email your notebook file to me at byoung@wyomingseminary.org, and use “Mathematica Project 10” as the subject line of your email.

One parametrization for a Möbius Strip is given by

$$\vec{r}(u, \theta) = \left\langle \left(1 + \frac{u}{2} \cos\left(\frac{\theta}{2}\right)\right) \cos(\theta), \left(1 + \frac{u}{2} \cos\left(\frac{\theta}{2}\right)\right) \sin(\theta), \frac{u}{2} \sin\left(\frac{\theta}{2}\right) \right\rangle$$

with parameters in the range $-1 \leq u \leq 1$ and $0 \leq \theta \leq 2\pi$.

- Use `ParametricPlot3D` to produce a plot of the Möbius Strip.
- Use a surface integral to compute the surface area of the Möbius strip.
- What happens when you substitute $\theta = 0$ and $\theta = 2\pi$ for the same value of the parameter u into the normal vector you found in the process of computing the surface integral? What property of this surface does this demonstrate? ¹

¹To substitute values into an expression in Mathematica, use a *replacement rule*. For example, $\frac{\theta}{2} \sin\left(\frac{\theta}{2}\right)$ /. ($\theta \rightarrow 2$) would substitute 2 for θ in the preceding expression.