In [1]:
```
import numpy as np
import matplotlib.pyplot as plt

class MobiusStrip:
    def __init__(self, R=1, w=0.2, n=100):
        self.R = R
        self.w = w
        self.n = n
        self._generate_mesh()

    def _generate_mesh(self):
        u = np.linspace(0, 2 * np.pi, self.n)
        v = np.linspace(-self.w / 2, self.w / 2, self.n)
        self.U, self.V = np.meshgrid(u, v)
        self.X = (self.R + self.V * np.cos(self.U / 2)) * np.cos(self.U)
        self.Y = (self.R + self.V * np.cos(self.U / 2)) * np.sin(self.U)
        self.Z = self.V * np.sin(self.U / 2)

    def compute_surface_area(self):
        du = 2 * np.pi / (self.n - 1)
        dv = self.w / (self.n - 1)
        Xu, Xv = np.gradient(self.X, du, dv, axis=(1, 0))
        Yu, Yv = np.gradient(self.Y, du, dv, axis=(1, 0))
        Zu, Zv = np.gradient(self.Z, du, dv, axis=(1, 0))
        cross = np.sqrt((Yu * Zv - Zu * Yv) ** 2 +
                        (Zu * Xv - Xu * Zv) ** 2 +
                        (Xu * Yv - Yu * Xv) ** 2)
        area = np.sum(cross) * du * dv
        return area

    def compute_edge_length(self):
        u = np.linspace(0, 2 * np.pi, self.n)
        v_edge = self.w / 2
        x = (self.R + v_edge * np.cos(u / 2)) * np.cos(u)
        y = (self.R + v_edge * np.cos(u / 2)) * np.sin(u)
        z = v_edge * np.sin(u / 2)
        dx = np.diff(x)
        dy = np.diff(y)
        dz = np.diff(z)
        length = np.sum(np.sqrt(dx**2 + dy**2 + dz**2))
        return length

    def plot(self):
        fig = plt.figure(figsize=(10, 6))
        ax = fig.add_subplot(111, projection='3d')
        ax.plot_surface(self.X, self.Y, self.Z, cmap='viridis', edgecolor='k',
        ax.set_title("3D Möbius Strip")
        ax.set_xlabel("X")
        ax.set_ylabel("Y")
        ax.set_zlabel("Z")
        plt.tight_layout()
        plt.show()
```

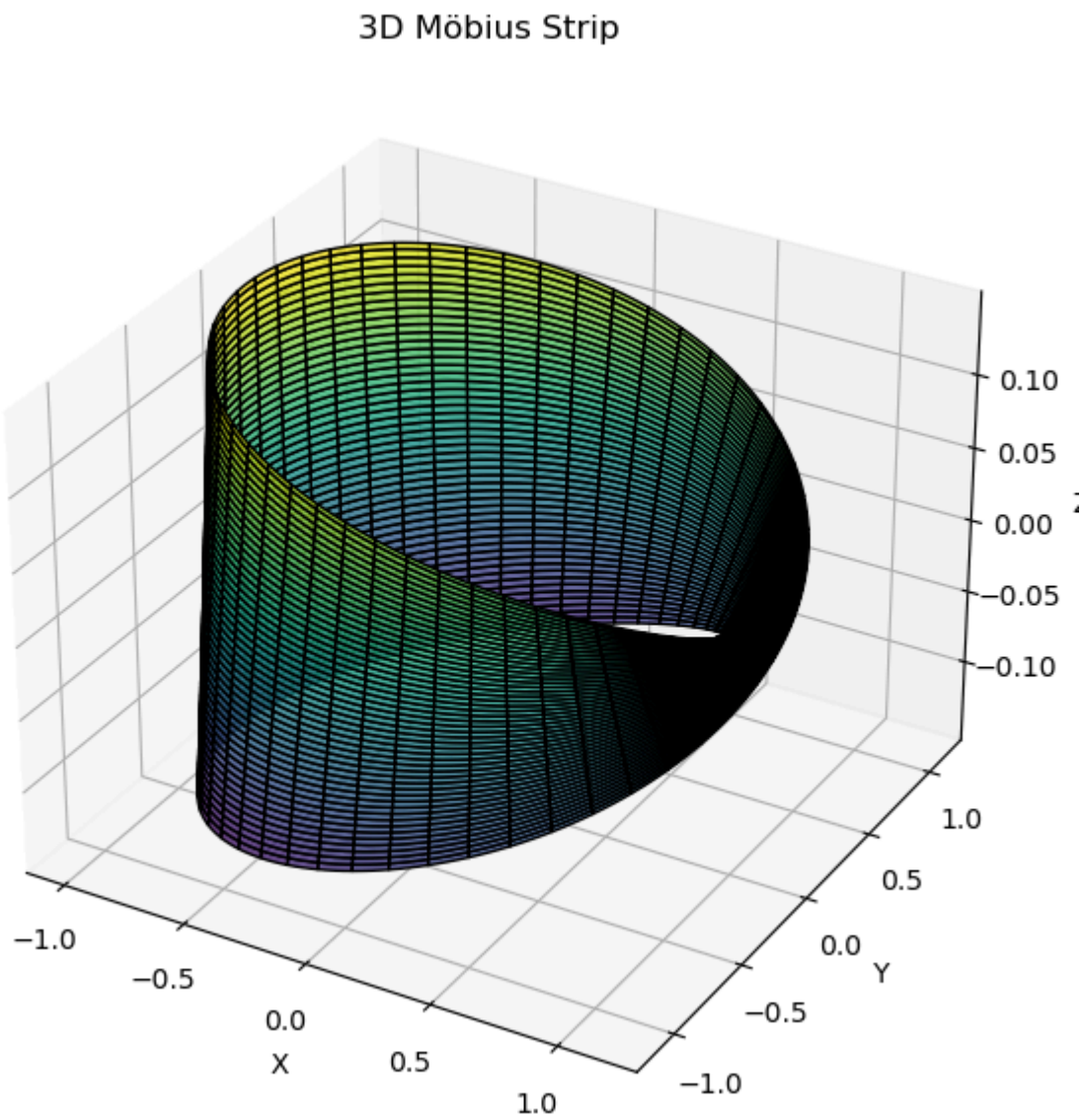
In [2]:
```
strip = MobiusStrip(R=1, w=0.3, n=200)

area = strip.compute_surface_area()
length = strip.compute_edge_length()

print(f"Surface Area ≈ {area:.4f}")
print(f"Edge Length ≈ {length:.4f}")

strip.plot()
```

```
Surface Area ≈ 1.9054
Edge Length ≈ 6.3008
```



In [ ]:
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