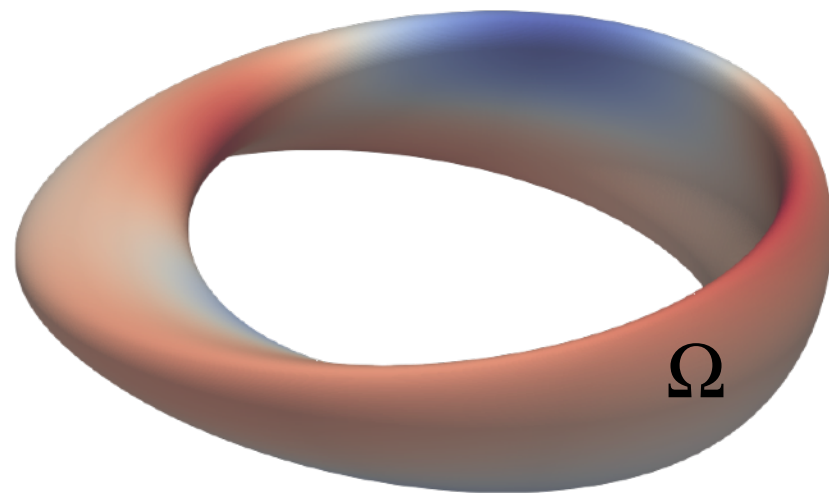
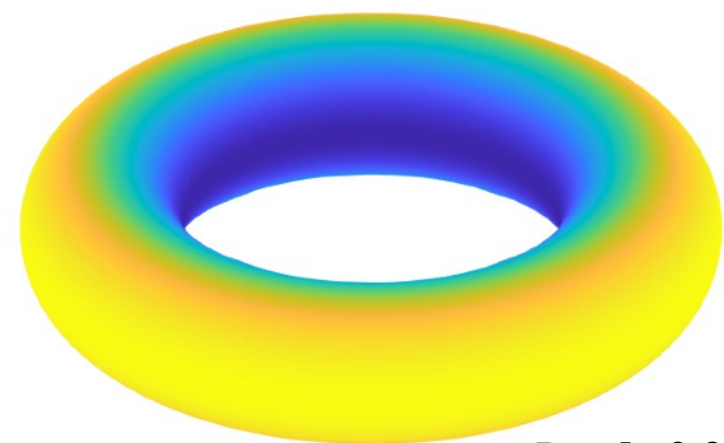


fmm3dBIE Challenge Problem

$$k_0 = 6\pi$$



Part 1: Best index of refraction



$$B = [-0.2, 0.2] \times [-0.2, 0.2] \times [2.1, 3.45]$$

First, illustrate correctness of the code by verifying an analytic solution, this is pre-requisite before proceeding to the next part.

Find best $n_r \in [1.3, 1.7]$ which maximizes

$$\int_B |u|^2 dV$$

Use the code provided in challenge_torus_ri.m

$$(\Delta + k_0^2)u_0 = 0 \quad x \in \mathbb{R}^3 \setminus \Omega$$

$$(\Delta + k_0^2 n_r)u_1 = 0 \quad x \in \Omega$$

$$u_0 - u_1 = -\exp(ik_0 x_3) \quad x \in \Gamma$$

$$\partial_n u_0 - \partial_n u_1 = -in_3 k_0 \exp(ik_0 x_3) \quad x \in \Gamma$$

Part 2: Best Ellipsoid configuration

Find the best configuration of 6 ellipsoids which maximizes the absolute value of the total field at $(0, 0, 1.65)$. The ellipsoids must satisfy the following constraints:

- Their centers must be at $z=0$, and $(x, y) \in [-1, 1]^2$
- Their semi major axes must be between $[0.15, 0.3]$
- The minimum distance between any two ellipsoids must be 0.15