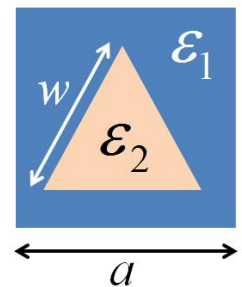
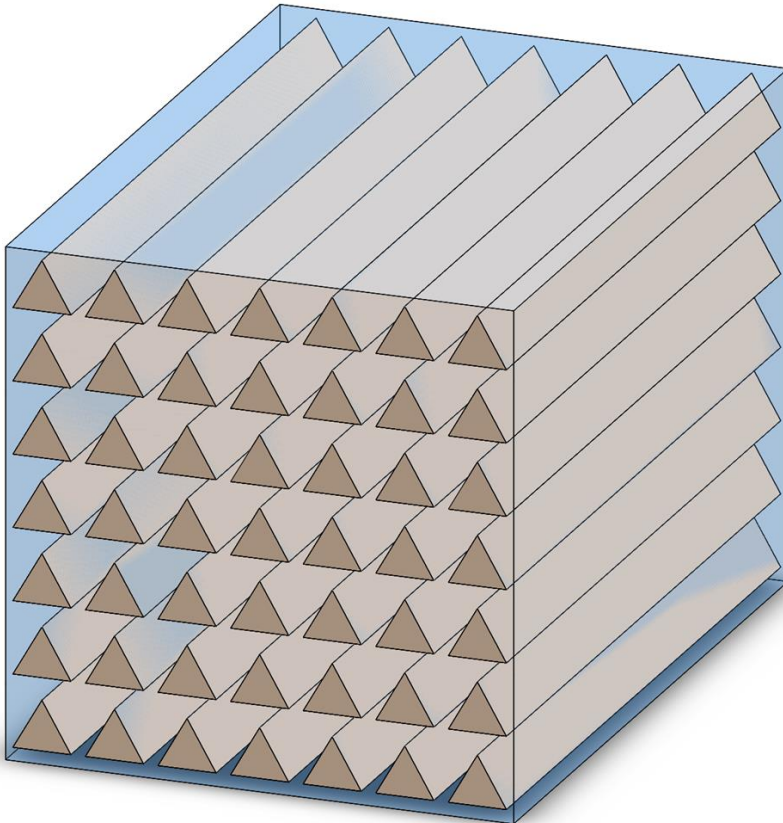


Problem #1: Electromagnetic Band Diagram

Calculate and plot the electromagnetic band diagram for both the E and H modes of the lattice shown below. You will be analyzing an infinitely periodic lattice, but only a 7×7 sample is shown below. Make your plots look professional and normalize the frequency axis according to $\omega a / 2\pi c_0$. Use $a=1$, $w=0.8a$, $\epsilon_r=9.0$, $\epsilon_r=1.0$.



Problem #2: Isofrequency Contours

Calculate and plot the isofrequency contours for the first and second bands of both the E and H modes for the lattice in Problem #1. Make your plots look professional and normalize the frequency according to $\omega a / 2\pi c_0$.

Problem #3: Self-Collimating Photonic Crystal

1. From the data calculated in Problem #2, identify the normalized frequency where self-collimation occurs for both the E and H modes.
2. Design a photonic crystal that self-collimates at 8.5 GHz. Choose whatever band and polarization that you think is best. Draw the lattice and label the dimensions with proper units.
3. Estimate the fractional bandwidth over which self-collimation occurs for the device designed above. Also provide the absolute bandwidth.