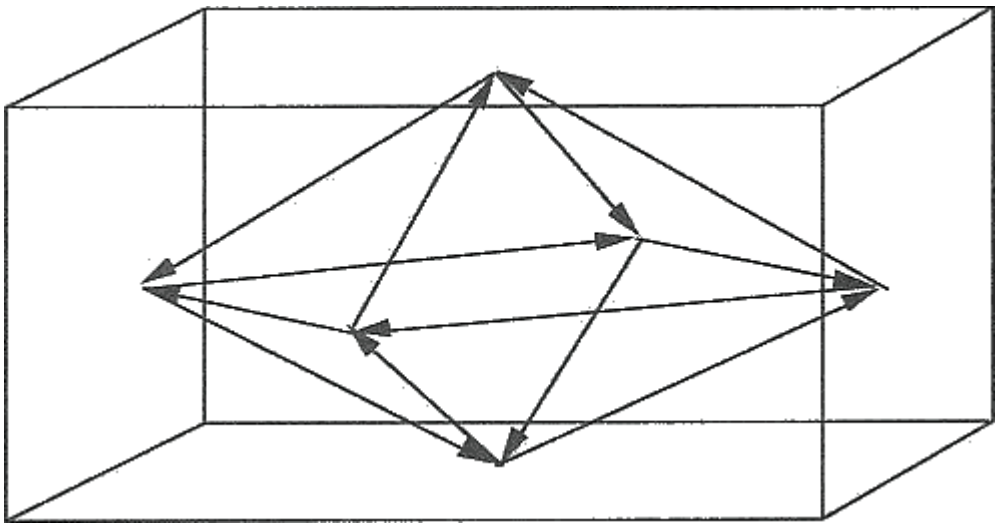
The next type of standing waves in a room are collectively known as 2-D <u>*tangential*</u> modes, where two of the three indices are non-zero, *e.g.* [*xyx*] = [*lm*0], [0*lm*] or [*l*0*m*], with integer *l*,*m* = 1,2,3,4… These modes have 2-D type standing waves of frequency

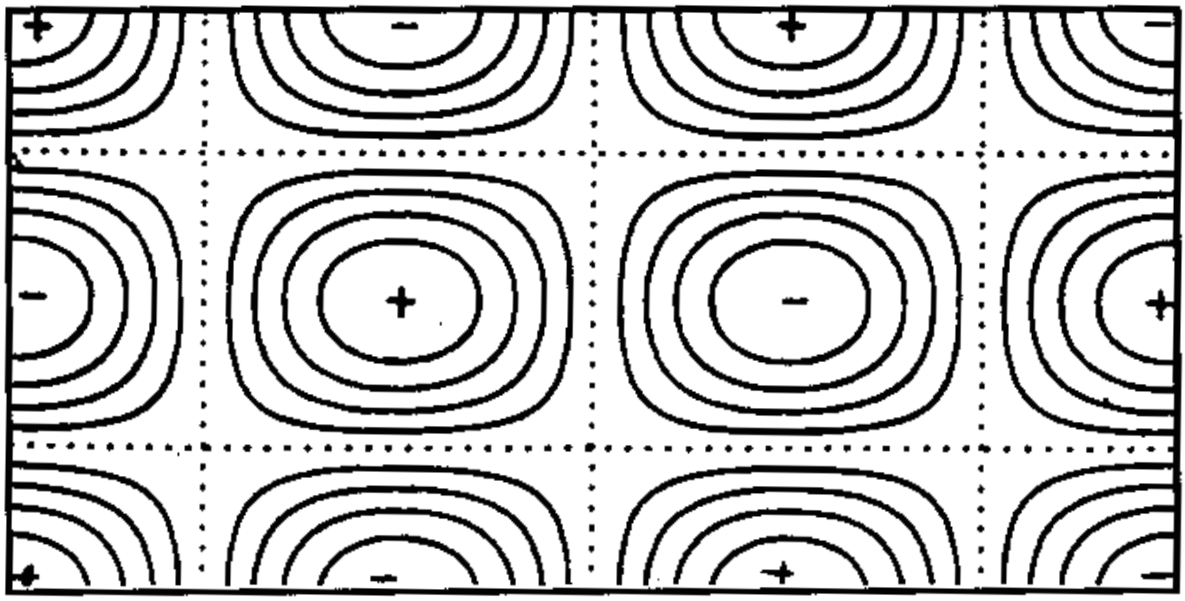
$$f_{lm0} = \tfrac{1}{2} v\sqrt{\left(l/L_x\right)^2 + \left(m/L_y\right)^2}\ ,\ f_{0lm} = \tfrac{1}{2} v\sqrt{\left(l/L_y\right)^2 + \left(m/L_z\right)^2} \text{ or } f_{l0m} = \tfrac{1}{2} v\sqrt{\left(l/L_x\right)^2 + \left(m/L_z\right)^2}$$

For 2-D tangential modes, four of the six surfaces of the room are involved in producing a tangential standing wave. 2-D paths that can be taken for such standing waves are shown in the figure below:



The wavelengths of tangential modes are *e.g.* $\lambda_{lm0} = 2\pi / k_{lm0} = 2\Big/\sqrt{\left(l/L_x\right)^2 + \left(m/L_y\right)^2}$, *etc.*

The pressure amplitude *e.g.* for the 320 tangential mode is shown in the figure below (dotted lines are pressure nodes, the + or – represent pressure anti-nodes):



(b)