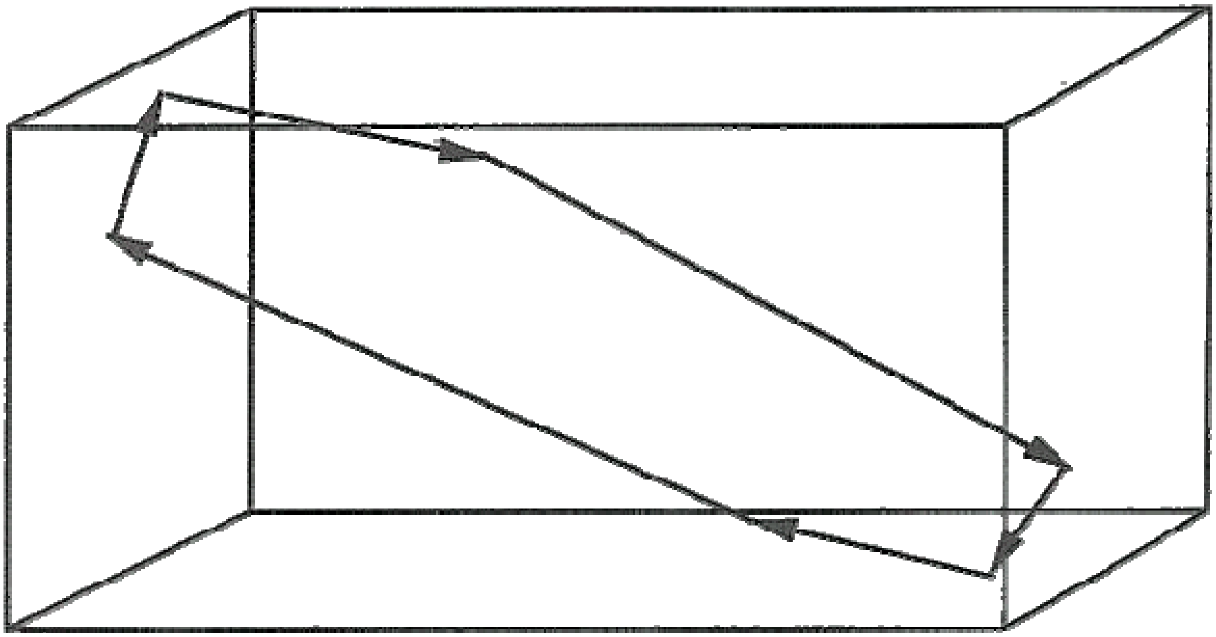
The third type of standing wave in a room are known as 3-D oblique modes, in which all six surfaces of the room are involved in producing standing waves, one such path is shown in the figure below:



For oblique modes, none of the [*xyz*] = [*lmn*] indices are zero, and hence the eigen-frequencies associated with oblique modes are given by the full 3-D formula

$f_{lmn} = \frac{1}{2} v \sqrt{\left(l/L_x\right)^2 + \left(m/L_y\right)^2 + \left(n/L_z\right)^2}$ with wavelength for the 3-D oblique modes of

$\lambda_{lmn} = 2 \Big/ \sqrt{\left(l/L_x\right)^2 + \left(m/L_y\right)^2 + \left(n/L_z\right)^2}$.

The 3-D longitudinal displacement amplitudes for the oblique-mode resonances in this room / auditorium are of the form:

$$\xi_{lmn}(x,y,z,t) = U_{lmn}(x,y,z)T_{lmn}(t) = X_l(x)Y_m(y)Z_n(z)T_{lmn}(t)$$
$$\xi_{lmn}(x,y,z,t) = A_{lmn}\sin(k_l x)\sin(k_m y)\sin(k_n z)e^{i(\omega_{lmn}t+\varphi_{lmn})}$$
$$\xi_{lmn}(x,y,z,t) = A_{lmn}\sin(l\pi x/L_x)\sin(m\pi y/L_y)\sin(n\pi z/L_z)e^{i(\omega_{lmn}t+\varphi_{lmn})}$$
$$l,m,n = 1,2,3,4,5,....$$

whereas the 3-D over-pressure amplitude for oblique-mode resonances in this room/auditorium are of the form:

$$p_{lmn}(x,y,z,t) = V_{lmn}(x,y,z)T_{lmn}(t) = F_l(x)G_m(y)H_n(z)T_{lmn}(t)$$
$$p_{lmn}(x,y,z,t) = C_{lmn}\cos(k_l x)\cos(k_m y)\cos(k_n z)e^{i(\omega_{lmn}t+\varphi_{lmn})}$$
$$p_{lmn}(x,y,z,t) = C_{lmn}\cos(l\pi x/L_x)\cos(m\pi y/L_y)\cos(n\pi z/L_z)e^{i(\omega_{lmn}t+\varphi_{lmn})}$$
$$l,m,n = 1,2,3,4,5,....$$