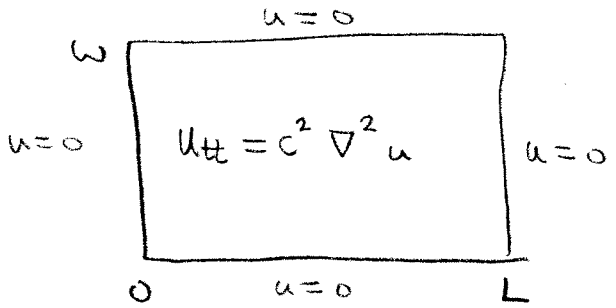
2-D Wave Equation Formulas



$T'' + \lambda c^2 T = 0$

$X'' + \mu X = 0$
$X(0) = 0$
$X(L) = 0$

$Y'' + (\lambda - \mu) Y = 0$
$Y(0) = 0$
$Y(\omega) = 0$

$$X_n(x) = \sin \frac{n\pi x}{L}$$

$$\mu_n = \left(\frac{n\pi}{L}\right)^2, \quad n = 1, 2, 3, \ldots$$

$$Y(y) = \sin \frac{m\pi y}{\omega}$$

$$(\lambda - \mu)_m = \left(\frac{m\pi}{\omega}\right)^2, \quad m = 1, 2, 3, \ldots$$

$$(\lambda - \mu_n)_m = \left(\frac{m\pi}{\omega}\right)^2 \Rightarrow \lambda_{n,m} = \left(\frac{n\pi}{L}\right)^2 + \left(\frac{m\pi}{\omega}\right)^2 > 0$$

$\mu_n \downarrow \left(\frac{n\pi}{L}\right)^2$

If $\lambda > 0$ we get oscillation in time (cosines & sines)
If $\lambda < 0$ we get exponential growth / decay.

$$T_{nm}(t) = A_{nm} \cos \sqrt{\lambda_{nm}}\, ct + B_{nm} \sin \sqrt{\lambda_{nm}}\, ct$$

$$u_{nm}(x, y, t) = T_{nm}(t)\, X_n(x)\, Y_m(y)$$