2-D Wave Equation Formulas

3-D Rectangular Coord: (x, y, z)

$$\nabla^2 u = \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2}$$

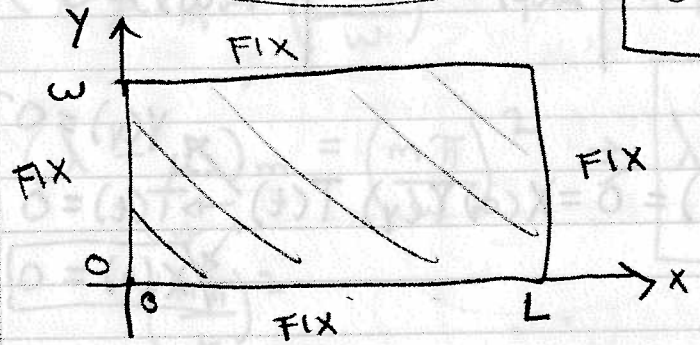
3-D Cylindrical Coord: (r, θ, z)

$$\nabla^2 u = \frac{1}{r}\frac{\partial}{\partial r}\left(r\frac{\partial u}{\partial r}\right) + \frac{1}{r^2}\frac{\partial^2 u}{\partial \theta^2} + \frac{\partial^2 u}{\partial z^2}$$

3-D Spherical Coord: (ρ, θ, ϕ)

$$\nabla^2 u = \frac{1}{\rho^2}\frac{\partial}{\partial \rho}\left(\rho^2\frac{\partial u}{\partial \rho}\right) + \frac{1}{\rho^2 \sin^2\phi}\frac{\partial^2 u}{\partial \theta^2} + \frac{1}{\rho^2 \sin\phi}\frac{\partial}{\partial \phi}\left(\sin\phi \frac{\partial u}{\partial \phi}\right)$$

Solving a 2-D Wave Equation



PDE: $u_{tt} = c^2(u_{xx} + u_{yy})$

B.C.'s: $u(0, y, t) = 0$
$u(L, y, t) = 0$
$u(x, 0, t) = 0$
$u(x, \omega, t) = 0$

} Homogeneous
Separate Variables

I.C.'s: $u(x, y, 0) = f(x, y)$
$u_t(x, y, 0) = g(x, y)$