

Classical Solution of Wave equation

$$\nabla^2 u = \frac{1}{c^2} \frac{\partial^2 u}{\partial t^2} ; u : \text{displacement}$$

- One dimensional

$$\frac{\partial^2 u}{\partial x^2} = \frac{1}{c^2} \frac{\partial^2 u}{\partial t^2}$$

$$u(x, t) = f(x - ct) + g(x + ct)$$

- Spherical Symmetry

$$\frac{\partial^2 u}{\partial r^2} + \frac{2}{r} \frac{\partial u}{\partial r} - \frac{2u}{r^2} = \frac{1}{c^2} \frac{\partial^2 u}{\partial t^2}$$

$$u(r, t) = f \frac{(r - ct)}{r} + g \frac{(r + ct)}{r}$$

- Cylindrical Symmetry

$$\frac{\partial^2 u}{\partial r^2} + \frac{1}{r} \frac{\partial u}{\partial r} - \frac{u}{r^2} = \frac{1}{c^2} \frac{\partial^2 u}{\partial t^2}$$

$$u(r, t) = \sum_{n=1}^{\infty} c_n J_1(\varepsilon_n \xi) \cos(\varepsilon_n \theta)$$

$$\xi = r/R, \theta = ct/R$$

