linearity2$_e$*quations*

Ruby Spring

December 2014

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

$$\frac{\partial^2 u}{\partial t^2} = c^2 \left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} \right)$$

$$\frac{\partial^2 u}{\partial t^2} = c^2 \left(\frac{\partial^2 u}{\partial r^2} + \frac{\partial u}{r \partial r} + \frac{\partial^2 u}{r^2 \partial \theta^2} \right)$$

$$\frac{\partial^2 u}{\partial r} \approx \frac{u_{n+1,m} - 2u_{n,m} + u_{n-1,m}}{(\Delta r)^2}$$

$$\frac{\partial u}{\partial r} \approx \frac{u_{n+1,m} - u_{n,m}}{\Delta r}$$

$$\frac{\partial^2 u}{\partial \theta^2} \approx \frac{u_{n,m+1} - 2u_{n,m} + u_{n,m-1}}{(\Delta \theta)^2}$$

where $u = u(x_1, x_2, \ldots x_n; t)$