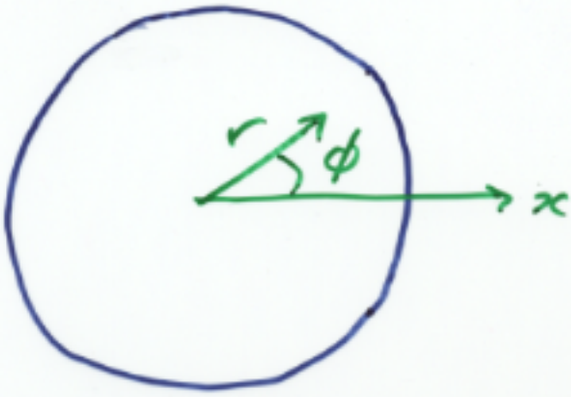
LECTURE 19

Hot plate



Heat-flow equation

$$\nabla^2 f = \frac{1}{r}\frac{\partial}{\partial r}\left(r\frac{\partial f}{\partial r}\right) + \frac{1}{r^2}\frac{\partial^2 f}{\partial \phi^2} = \frac{1}{D}\frac{\partial f}{\partial t}$$

Subject to b.c.'s

$$f(r,\phi,t) = f(r,\phi+2\pi,t)$$

$$\left.\frac{\partial f}{\partial r}\right|_{r=a} = 0, \quad \text{regular at } r=0$$

Separable solutions

$$f(r,\phi,t) = J_m(kr)\left[A_m \cos m\phi + B_m \sin m\phi\right] e^{-\gamma t}$$

where

$$m = 0, 1, 2 \ldots.$$

$$J_m'(ka) = 0$$

$$\gamma = Dk^2 \quad \text{relaxation rate}$$