

Poisson's and Laplace's Equations (H.1)

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Based on
Engineering Electromagnetics
Hayt & Buck

$$\nabla^2 V = \frac{\partial^2 V}{\partial x^2} + \frac{\partial^2 V}{\partial y^2} + \frac{\partial^2 V}{\partial z^2} = -\frac{\rho_v}{\epsilon}$$

$$\nabla^2 V = 0$$

$$\nabla^2 V = \frac{\partial^2 V}{\partial x^2} + \frac{\partial^2 V}{\partial y^2} + \frac{\partial^2 V}{\partial z^2} = 0$$

$$\nabla^2 V = \frac{1}{\rho} \frac{\partial}{\partial \rho} \left(\rho \frac{\partial V}{\partial \rho} \right) + \frac{1}{\rho^2} \left(\frac{\partial^2 V}{\partial \phi^2} \right) + \frac{\partial^2 V}{\partial z^2}$$

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

$$V = \frac{V_0 x}{d}$$

$$C = \frac{|Q|}{V_0} = \frac{\epsilon S}{d}$$

$$V = V_0 \frac{\ln(b/p)}{\ln(b/a)}$$

$$C = \frac{2\pi\epsilon_0 L}{\ln(b/a)}$$

$$V = V_0 \frac{\phi}{\alpha}$$

$$E_r = - \frac{V_0 a \phi}{\alpha p}$$

$$V = \frac{\frac{1}{r} - \frac{1}{b}}{\frac{1}{a} - \frac{1}{b}}$$

$$C = \frac{4\pi\epsilon}{\frac{1}{a} - \frac{1}{b}}$$

$$V = V_0 \frac{\ln(\tan \frac{\theta}{2})}{\ln(\tan \frac{\alpha}{2})}$$

$$C = \frac{2\pi\epsilon r_1}{\ln(\cot \frac{\alpha}{2})}$$

$$V_0 = \frac{1}{4} (V_1 + V_2 + V_3 + V_4)$$