5.14 The magnetic scalar potential is given by

$$\Phi_m = \sum_{m=0}^{\infty} a_m \rho^m \cos(m\phi), \quad \rho < a$$

$$\Phi_m = \sum_{m=0}^{\infty} \left(b_m \rho^m + c_m \rho^{-m} \right) \cos(m\phi), \quad a < \rho < b$$

$$\Phi_m = \sum_{m=0}^{\infty} d_m \rho^{-m} \cos(m\phi) - H_0 \rho \cos\phi, \quad \rho > b.$$

Where $H_0 = B_0/\mu_0$. It is clear, that only $m=1$ term will contribute to the final solution. Consider the continuity conditions for the magnetic induction and magnetic field,

$$\left.\frac{\partial \Phi_m}{\partial \rho}\right|_{\rho=a-} = \mu_r \left.\frac{\partial \Phi_m}{\partial \rho}\right|_{\rho=a+}, \quad \mu_r \left.\frac{\partial \Phi_m}{\partial \rho}\right|_{\rho=b-} = \left.\frac{\partial \Phi_m}{\partial \rho}\right|_{\rho=b+}$$

$$\left.\frac{\partial \Phi_m}{\partial \phi}\right|_{\rho=a-} = \left.\frac{\partial \Phi_m}{\partial \phi}\right|_{\rho=a+}, \quad \left.\frac{\partial \Phi_m}{\partial \phi}\right|_{\rho=b-} = \left.\frac{\partial \Phi_m}{\partial \phi}\right|_{\rho=b+}$$

we have

$$\begin{cases} a^2 a_1 - \mu_r a^2 b_1 + \mu_r c_1 = 0 \\ a^2 a_1 - a^2 b_1 - c_1 = 0 \\ -\mu_r b^2 b_1 + \mu_r c_1 - d_1 = b^2 H_0 \\ b^2 b_1 + c_1 - d_1 = -b^2 H_0 \end{cases} \Rightarrow \begin{cases} a_1 = \dfrac{4\mu_r b^2}{(\mu_r-1)^2 a^2 - (\mu_r+1)^2 b^2} H_0 \\ b_1 = \dfrac{\mu_r+1}{2\mu_r} a_1 \\ c_1 = \dfrac{\mu_r-1}{2\mu_r} a^2 a_1 \end{cases}$$

$$d_1 = \frac{2\mu_r c_1 + (\mu_r - 1) b^2 H_0}{\mu_r + 1} = \frac{(\mu_r^2 - 1) b^2 (a^2 - b^2)}{(\mu_r-1)^2 a^2 - (\mu_r+1)^2 b^2} H_0$$