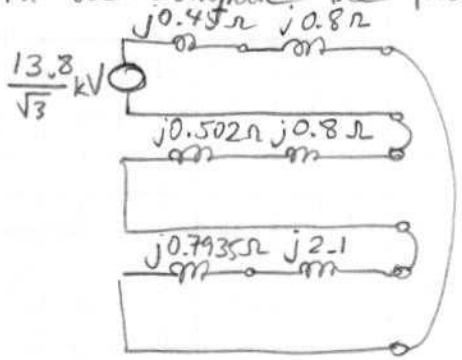
Problem 1

First we compute the fault current



$$I_o = \frac{13.8\ kV}{\sqrt{3}} \Big/ (j5.4457) = -j1.463\ kA$$

$$\tilde{I}_F = \tilde{I}_A = j4.3892\ kA$$

$$\tilde{I}_{relay} = j18.28\ A$$

$$\frac{I_{relay}}{8.0A} = 2.286$$

Reading the figure for 2.288 @ time dial 1

$$\Rightarrow \quad t_{trip} = 0.7 \text{ seconds}$$

Problem 2

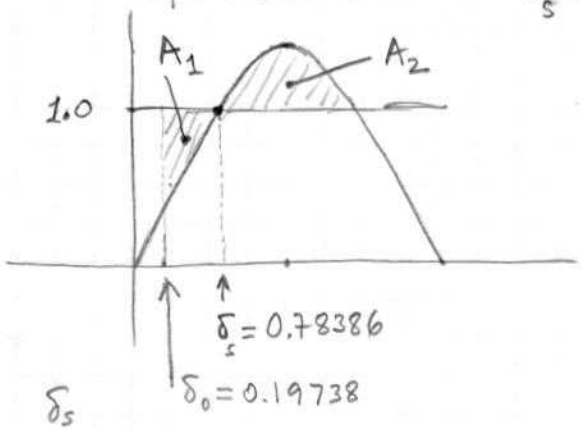
Pre-disturbance $V_b e^{j\alpha} \rightarrow 1.0 e^{j0^\circ}$

$$E e^{j\delta} = 1.0 + (j0.20)(1.0) = 1.0198 e^{j11.309^\circ}$$

Post-Disturbance $P_e = 1.416389 \sin\delta$

Initial condition $\delta_0 = 11.309^\circ$

Equilibrium $\delta_s = 44.912^\circ$



$$A_1 = \int_{\delta_0}^{\delta_s} (1.0 - 1.416389 \sin\delta)\, d\delta = 0.200667$$

$$A_2 = \int_{\delta_s}^{\pi - \delta_s} (1.416389 \sin\delta - 1.0)\, d\delta = 0.43228$$

Since $A_2 > A_1 \Rightarrow$ System stable