Problem 1

(b) A car moving 60 mph, 3000 lbs, has a kinetic energy

$$K_{e,car} = 4.895 \times 10^5 \text{ J} \quad \text{(see problem P13.1)}$$

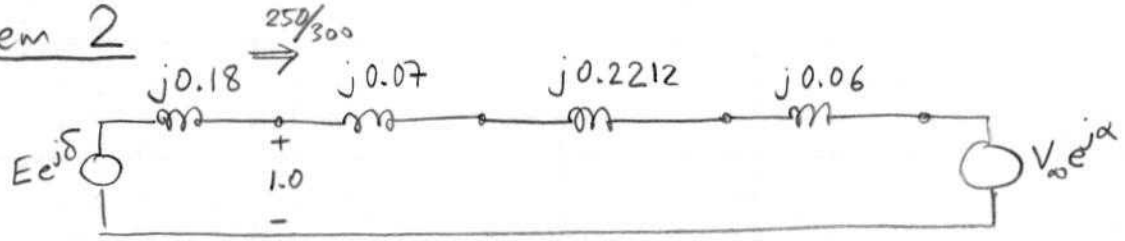
(a) A 1,000,000 MVA, 3.2 sec generator has kinetic energy

$$K_{e,g} = S \cdot H = 3.2 \times 10^{12} \text{ J}$$

$$\text{Thus} \quad N_{cars} = \frac{K_{e,g}}{K_{e,car}} = 653{,}728 \text{ cars}$$

Problem 2

a)



$$E e^{j\delta} = 1.0 + j(0.18)\left(\frac{250}{300}\right) = 1.0112\, e^{j\,8.5307^\circ}$$

$$V_\infty e^{j\alpha} = 1.0 - j(0.07+0.2212+0.06)\left(\frac{250}{300}\right) = 1.0419\, e^{-j\,16.313^\circ}$$

$$\Rightarrow \quad \tilde{E} = 1.0112\, e^{j\,24.8437^\circ}, \quad \tilde{V}_\infty = 1.0419\, e^{j\,0^\circ}$$

$24.8437^\circ \Leftrightarrow 0.4336 \text{ rad}$

(b) For the time interval $0 < t < 0.15 \Rightarrow P_e = 0$

$$\Rightarrow \quad \frac{(2)(2.8)}{377}\frac{d^2\delta(t)}{dt^2} = P_m = 0.8333$$

$$\Rightarrow \quad \delta(t) = 28.0505\, t^2 + 0.4336, \quad 0 < t < 0.15$$

(c) When breaker recloses

$$P_e = \frac{(1.0112)(1.0419)}{0.5312}\sin\delta = 1.983376 \sin\delta$$

at $t = 0.15 \Rightarrow \delta(t=0.15) = 1.46446$ rads $\Rightarrow (83.9077^\circ)$

$$P_e = 1.983376 \sin(1.46446) = 1.97217 \text{ pu}$$