ECE 667 Homework 2
Due Thursday September 23, 2021

1. A new three-phase, 60 Hz transmission line is to be built using Parrot conductor. Parrot conductor has an outside diameter of 1.506 inches; stranding of 54/19 (Al/St), which yields a GMR for the conductor of 0.0507 feet. Resistance at 60-Hz is 0.0622 Ω/mile. The tower to be used has the three conductors in a horizontal configuration with the phase conductors 35 feet above the ground and spaced 14 feet apart (i.e., from left to center is 14 feet, center to right is 14 feet, and left to right is 28 feet). Fifteen feet above the phase conductors are two ground conductors, one 8 feet to the left of center and one 8 feet to the right of center. The ground wires use Partridge conductors, with an outsider diameter of 0.642 inches and a GMR of 0.0217 feet. Resistance at 60-Hz is 0.350 Ω/mile. Assume ground resistivity of 60 Ω-m.

   a. Using the approach discussed in class, calculate the three by three phase impedance matrix, in Ω/mile.
   b. Using your result from part a, calculate the three by three sequence impedance matrix.

2. Using PowerWorld with the wscc_9bus_WithGovernors case change the contingency from opening the bus 3 generator to opening the load at bus 8. Over the course of the 20 second simulation what is the highest bus frequency and what is the final bus frequency (to 0.01 Hz)?

3. Using PowerWorld with the AGL37_TS case change the contingency to a zero impedance, three-phase fault on the line between buses 28 and 31 at the bus 28 end. Assume this fault is cleared by opening the line. Determine the maximum fault duration if there is a requirement that no generator speed exceed 60.3Hz. What is the maximum fault duration before a generator loses synchronism?

4. Repeat Problem 4, except assume the fault occurs midway (50%) between buses 28 and 31.