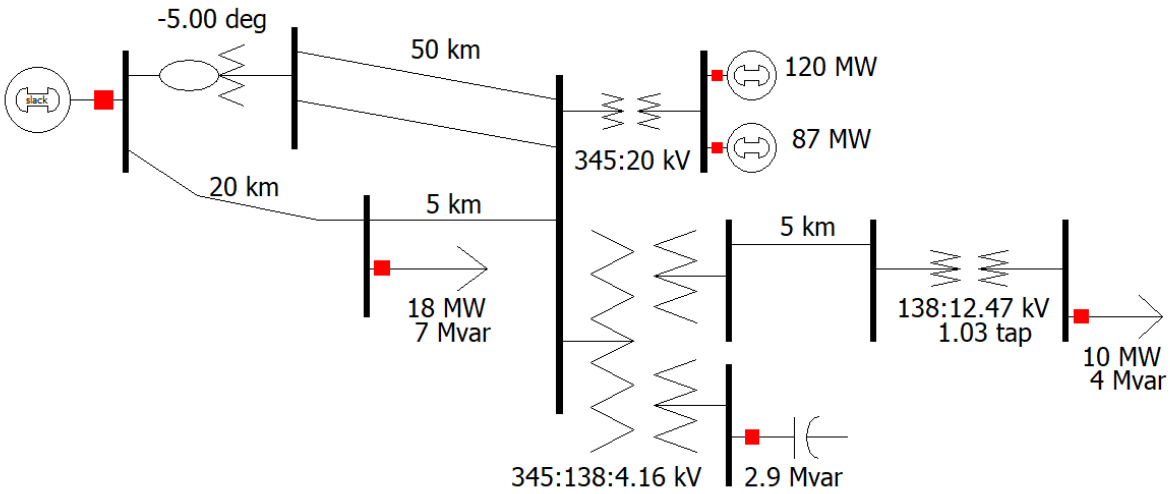
Review for ECEN 615 Exam 1

Adam Birchfield, Texas A&M University, 10/2/2023



In the system above, assume

- All transmission lines have per-unit, per-kilometer values of X=0.002, R=0.0001, B=0.01
- All the two-winding transformers have a nominal impedance of X=0.1, R=0
- The three-winding transformer has Xhl=0.15, Xhm=0.12, Xml=0.09, with R=0
- The phase-shifting transformer is subject to an impedance correction table below

Phase (degrees)	-20	0	20
Z multiplier	1	0.01	1

- The two generating units in the upper right are regulating the 345 kV bus voltage to 1.05
- Make other reasonable assumptions as necessary

Review Questions on the Example System

1. How do you calculate the y-bus for the example system?
2. What are the bus types, variables, and types of equations for the above system?
3. What would be the dimensions of the Jacobian?
4. Without solving, what do you expect for approximate P value of the slack bus?
5. What would the DC power flow predict? (ignoring the phase shift for this, although some DC power flow methods include it)
6. How would you handle var sharing between the two generators?
7. Under what conditions would the capacitor likely be switched out of service?
8. What is the likely purpose and function of the phase shifting transformer?
9. If the two generators reached their reactive power limit, how would that affect the way the power flow solves?

10. Assume the slack bus represents a neighboring area to which your area is contracted to export 150 MW. What is the current approximate ACE and what controls could be used to fix it?

Other Review Questions

11. What are the key things that happened in the 1860-1900 era for power systems?
12. What are the key things that happened in the 1900-1940 era for power systems?
13. What are the key things that happened in the 1940-1980 era for power systems?
14. What are the key things that happened in teh 1980-2010 era for power systems?
15. What are the key things that happened in the 2010-2023 era for power systems?
16. What are expected things in the near and far future for power systems?
17. What are the different time scales power systems are modeled for? What types of modeling decisions are made for those different time scales?
18. What makes power flow a non-linear problem and what does that mean?
19. How well does Newton-Raphson converge? What factors make it converge worse and better?
20. How do we handle generator reactive power limits in power flow?
21. How do we handle voltage dependent load in power flow?
22. What is a bus? breaker?
23. What are some of the different configurations for substation layout and the benefits/detriments of each?
24. What's the difference between node/breaker and bus/branch modeling? (EMS vs planning model)
25. What does topology processing do?
26. What are the different ways to connect a two-winding, three-phase transformer? What are they typically used for?
27. What is an autotransformer? Where do you see them? How are they modeled?
28. What are three-winding transformers used for? How are they modeled?
29. How are tap-changing transformers modeled?
30. How are phase-shifting transformers modeled?
31. What is an impedance correction table?
32. What is the difference between continuous and discrete shunt reactive power sources?
33. What are the differenc complexities that can occur with generator voltage/reactive power control?
34. What is the most computationally complex part of the power flow?
35. What does the power flow optimal power multiplier do?
36. What are the advantages/disadvantages of the dishonest NR, decoupled PF, and FDPF?
37. How does the DC power flow differ from the NR power flow?
38. What assumption does the DC power flow make with respect to real power flow?