sdmay19-46: Impact of High Photovoltaic Penetration on Distribution Systems

Advisor: Dr. Ajjarapu
Week 2 Report
September 12 - September 20

Team Members

Daniel Tott - Team Leader
Nathan McGlaughlin - Webmaster
Jasleen Grover - Key Concept Holder 1
Minsung Jang - Key Concept Holder 2

Summary of Progress this Report

In the past week we focused on solving the IEEE 4 bus system by hand. This was our main goal for this week as we learned another way of solving it through using a different method of calculating the line currents. Also, settled on what the proper steps for solving the power flow were as a group. We all have the textbook, "Distribution System Modeling and Analysis" by William Kersting, and read ch. 4 in order to gain a better understanding of how distribution lines are worked with.

Past Week Accomplishments

Everyone:

- Did everything together at the same time as a group, so there are no separate accomplishments
- Read Ch. 4 of "Distribution System Modeling and Analysis" by William Kersting
    - Read chapter 4, which gave us more insight to overhead and underground distribution lines.
    - Found how the impedance matrices of the lines in our 4 node system were computed in a three-phase format. The impedance matrices were already given to us, but this chapter showed us how they could be calculated when given nominal impedance values.
    - Found how different conductors will be used in the distribution systems that we model. There are several common overhead and underground conductors that we will need to define when we start modeling distribution systems using software.
- Corrected our method for finding the line currents
    - Found we only needed to use the transformer ratio in order to find the current through line 1.
- Found the proper steps for the power flow.
    - Found that to solve the power flow correctly, we need to start with the known load power, and the nominal voltage for node 4, which is the load.
    - Next, use the impedance of the distribution line connecting to the load (line 2) to find the current going through that line.
    - Use the current through the line to find the voltage for node 3.
    - Use the given data for the transformer to find the voltage for node 2, and the current through line 1.
    - Can then find the voltage for node 1, and go back to node 4 and repeat.
- Solved the power flow for the 4 node system by hand, and then in MATLAB.
    - After solving the system by hand, we repeated further iterations using MATLAB, and found that the load voltage converged, but was again different from IEEE's solution.

Pending Issues

Everyone:

- IEEE 4 Bus - set the generator node's voltage to a constant.
    - Found the reason our solution was off was that we were constantly solving for the different voltage for the generator node (node 1).
    - Need to set the generator node to a constant (7.2 kV l-n) as that would constantly be supplied, and will deter the other values from fluctuating.

Plans for Upcoming Reporting Period

Everyone:

- Solve the IEEE 4 Bus System by Hand
    - We will work together on solving the IEEE 4 bus system by hand, and set the generator node voltage to a constant value in order to get the correct solution.
    - Will go through the first iteration by hand once again, and then fix our MATLAB code to account for the changes that we will be making.
    - Expect having the generator node voltage set as a constant to allow the load voltage to converge to the same value found by IEEE.

Individual Contributions

Team Member	Contributions	Weekly Hours	Total Hours
Daniel Tott	Did research on distribution systems, and solved problems relating to distribution systems. Problems were solved from the textbook. Most of the work was on solving a power flow for IEEE's 4 node test distribution system. This work was done by hand, and most of the computation was through MATLAB as a group.	8	23
Nathan McGlaughlin	This week I attempted to solve the IEEE 4 bus system by hand.	8	20
Jasleen Grover	Solved the 4 bus systems. Did the assigned reading given by the advisor.	6	17
Minsung Jang	I struggled with understanding how to solve the IEEE 4 bus system, and to understand overall power flow system in order to set a basis for our project.	8	13

Gitlab Activity Summary

Gitlab Report

- Nothing to report.