**Programming/Simulation Assignments**

– Submit a report summarizing each step of the following simulations.

**Part 1- Understand distribution feeder**

1. Go to this website <https://site.ieee.org/pes-testfeeders/resources/>
2. Download 13-bus feeder. This is a distribution test feeder. Study the properties and summarize its characteristics.

**Part 2 - Power flow analysis in OpenDSS**

1. Download OpenDSS <https://sourceforge.net/projects/electricdss/>
2. Locate the following folder inside the OpenDSS folder (C:\Program Files\OpenDSS\IEEETestCases\13Bus)
3. Run IEEE13Nodeckt.dss. This will run power flow for the system. Export voltages.
4. Plot voltage profile for the feeder. For this you need to get node voltages after solving the power (running the file solves for power flow) and then export that to excel or MATLAB to get a voltage profile plot.

**Part 3 – Fault Analysis in OpenDSS**

1. Locate this file in doc folder - OpenDSS FaultStudy Mode.pdf. Read this to find out how to OpenDSS does fault analysis. It is located in the following folder C:\Program Files\OpenDSS\Doc
2. Add the following code snippet to solve the 13-node ckt in fault mode. You need to add those codes to IEEE13Nodeckt.dss. Rename this file as IEEE13NodecktFault.dss.

solve mode=f

show f

1. Run IEEE13NodecktFault.dss to generate a fault study report.
2. Understand the fault report and comment on the results.

**Programming/Simulation Assignments**

**Part 1- Understand distribution feeder and Power flow analysis in OpenDSS**

1. Go to this website <https://site.ieee.org/pes-testfeeders/resources/>
2. Download 123-bus feeder. This is a distribution test feeder. Study the properties and summarize its characteristics.
3. Locate the following folder inside the OpenDSS folder (C:\Program Files\OpenDSS\IEEETestCases\123Bus)
4. Run IEEE123NodeBUS.dss. This will run power flow for the system. Export voltages. Plot voltage profile for the feeder. For this you need to get node voltages after solving the power (running the file solves for power flow) and then export that to excel or MATLAB to get a voltage profile plot. You will get three plots for three-phase voltages. Record the total power loss.

**Part 2 – Frequency Scan**

1. Locate the following folder inside the OpenDSS folder (C:\Program Files\OpenDSS\Examples\FreqScan)
2. Run Run\_Scan.dss. This script runs frequency scan on opendss for 123-bus system. Note that you need to change the path here to match the file location in your system.

Redirect "C:\Users\prdu001\OpenDSS\Distrib\IEEETestCases\123Bus\IEEE123Master.dss"

1. What does this code snippet do?

New spectrum.Scanspec numharm=1000 csvfile=ScanSpectrum.csv

1. What does this code snippet do?

New Isource.scansource bus1=83 amps=1 spectrum=scanspec

1. What does this code snippet do?

New Monitor.Mscan Line.l84 1

1. What does this code snippet do?

solve mode=harmonics

Export monitors mscan

1. Export the results for frequency scan to matlab/excel. Plot the frequency scan plot. Explain the results.

**Part 3 – Harmonic Analysis**

1. Modify all connected loads in IEEE 123-bus system to have the following harmonic spectrum

NumHarm=5 harmonic=(1, 5, 7, 11, 13) %mag=(100, 3, 2, 1, 0,)

1. Do harmonic power flow analysis. Export node voltages. It should include harmonic components.
2. Plot fundamental component of node voltages in Matlab. Compare the results against those obtained in Step 4. Comment on the results.
3. Compare the power losses obtained with harmonics with those obtained in step 4. Comment on results.
4. Write a small matlab program to calculate voltage THD for all nodes in 123-bus system. Use that to calculate the voltage THD. Comment on the results specifically how voltage THD changes with respect to distance from the substation. Is the distribution system operating with acceptable parameters? Comment with respect to measured voltage THD.
5. Consider the following bus, Bus1=65. Note that it is supplying a delta load. Record the current flow in the transformer supplying this load. Does the transformer need to be overrated? Note that analysis will require measuring current THD and derating considerations.