II.B Use GS method to Find a Initial Solution

where k represents the number of iteration while i and n represent the column and row in the matrix Y, also they represent the bus number. But we will find that this is not enough for all the buses calculation. For PV bus, we need to guess an initial value for the voltage phase angle. Then we use the product of our guessed voltage and Y admittance matrix to calculate the guessed power. We take the imaginary part of the power as the Q (reactive power) of the PV bus. Then we through it into GS iterations like what PQ bus does above. The differences include that the voltage absolute value is fixed as given, we calculate the phase angle in each iteration as updates. Also, we need to calculate the Q for PV bus each iteration as updates.

C. Use the solution for NR method

After we finish the GS iteration, we have an initial guess of node voltages, which we will use for the calculation of NR method to calculate node powers [4]. From what we have learnt in classes, we firstly divide the Y admittance matrix to G and B matrix, where G matrix is the real part and the B matrix is the imaginary part. From the equation (2) and (3) we formulate our f(x) which will be used in NR iterations when the Our epsilon value here is .

Pi = ∑ N n=1 |Vn||Vi |(Gincosδin+Binsinδin) = PGi−PDi (2)

Qi = ∑ N n=1 |Vn||Vi |(Ginsinδin − Bincosδin) = QGi – Qdi (3)

f(x) = x=

i represents the phase angle for bus i, and Vi is the absolute value for it. One thing we need to notice is that i to n is from the first bus to the last bus except the slack bus. After we get our GS result, we take the voltage result as our initial guess for further iteration use. Then we need to use that given bus information to calculate the f(x) matrix. The most important part of NR method is calculating the first order derivation matrix from the f(x). This matrix has been learnt in class named Jacobian matrix. So, we do not explain much about the Jacobian matrix here. At last, we need to run our NR iteration through the equation below:

We repeat this equation as our NR iterations until we get as an ending signal. Hence, we get our NR method result.