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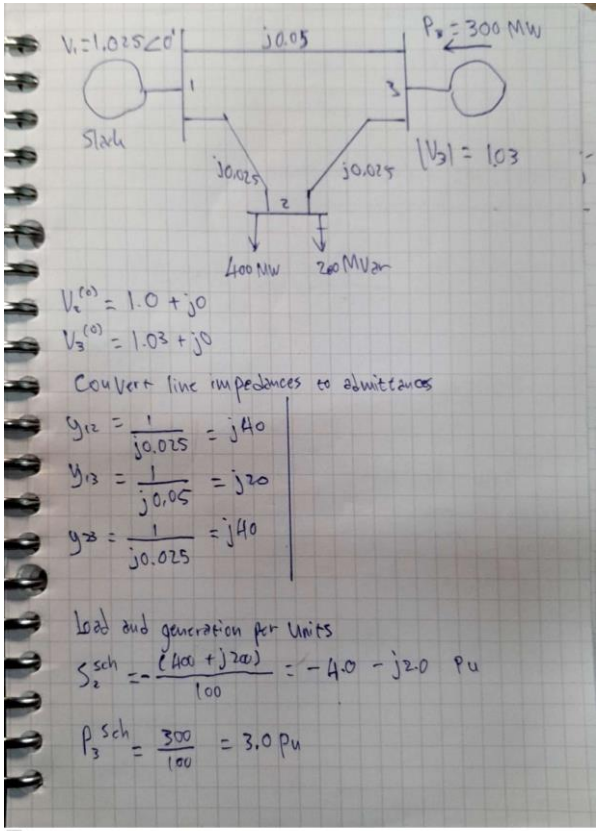
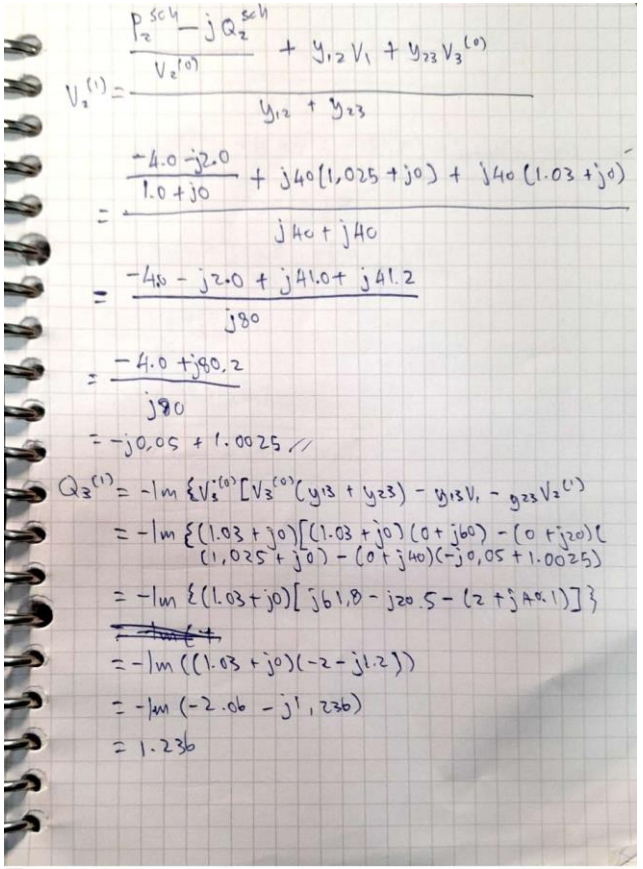
Electrical Engineering

Power system and control: HW1

a.





$$V_{c3}^{(1)} = \frac{\frac{P_3^{sch} - jQ_3^{sch}}{V_3^{(0)}} + y_{13}V_1 + y_{23}V_2^{(1)}}{y_{13} + y_{23}}$$

$$= \frac{\frac{3 - j1,236}{1.03 + j0} + (0 + j20)(1.025 + j0) + (0 + j40)(-j0.05 + 1.0025)}{j20 + j40}$$

$$= \frac{291 + j12 + j20,5 + (-2) + j40.1}{j60}$$

$$= \frac{0,91 + j61.8}{j60}$$

$$= 1,03 + j0.015167$$

$$e_3^{(1)} = \sqrt{1.03^2 - (0.015167)^2}$$

$$= 1.02989$$

$$V_3^{(1)} = 1.02989 + j0.015167$$

$$V_2^{(2)} = \frac{\frac{P_2^{sch} - jQ_2^{sch}}{V_2^{*(1)}} + y_{12}V_1 + y_{23}V_3^{(1)}}{y_{12} + y_{23}}$$

$$= \frac{\frac{-4 - j3}{-j0.05 + 1.0025} + jA0(1.025) + j40(1.02989 + j0.01516)}{j40 + j40}$$

$$= \frac{-3.89087 - j2.18857 + j41 + j41.1956 - 0,60668}{j80}$$

$$= \frac{-4.48755 + j80.00703}{j80}$$

$$= -1.00009 - j0.0561$$

b. Not enough time

c.

andy.m

```
clear;
basemva = 100;
accuracy  = 0.001;
accel = 1.6;
maxiter = 80;

busdata=[1  1   1.025   0   0   0   0   0   0   0   0
         2  0   0       0   4   2   0   0   0   0   0
         3  2   1.03    0   0   0   3   0   0   0   0];

linedata=[  1   3   0   0.05    0   1
            1   2   0   0.025   0   1
            2   3   0   0.25    0   1];
import Lfybus.*;
import Lfgauss.*;
import Busout.*;
import Lineflow.*;
Lfybus
Lfgauss
Busout
Lineflow
```

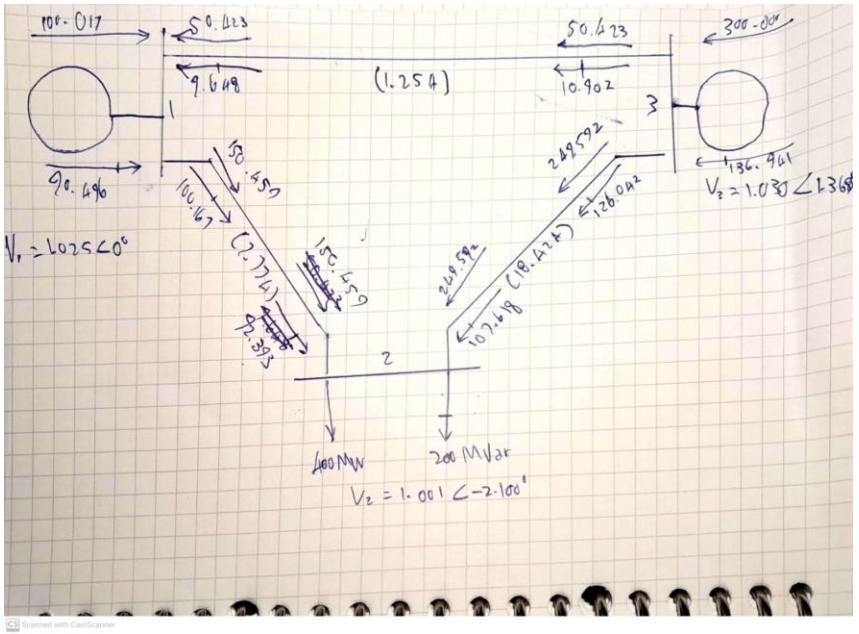
```
>>andy
Power Flow Solution by Gauss-Seidel Method
                      Maximum Power Mismatch = 0.000408542
                            No. of Iterations = 18

    Bus  Voltage  Angle    ------Load------    ---Generation---   Injected
    No.  Mag.     Degree     MW       Mvar       MW       Mvar       Mvar

     1   1.025    0.000     0.000     0.000   100.017    90.496     0.000
     2   1.001   -2.100   400.000   200.000     0.000     0.000     0.000
     3   1.030    1.368     0.000     0.000   300.000   136.941     0.000

    Total                400.000   200.000   400.017   227.437     0.000


                         Line Flow and Losses

     --Line--  Power at bus & line flow    --Line loss--  Transformer
     from  to    MW      Mvar     MVA       MW      Mvar      tap

     1        100.017   90.496  134.882
           2  150.459  100.167  180.752    0.000    7.774
           3  -50.423   -9.648   51.338    0.000    1.254

     2       -400.000 -200.000  447.214
           1 -150.459  -92.393  176.563    0.000    7.774
           3 -249.592 -107.618  271.805    0.000   18.424

     3        300.000  136.941  329.777
           1   50.423   10.902   51.588    0.000    1.254
           2  249.592  126.042  279.612    0.000   18.424

    Total loss                             0.000   27.452
```

d. Explain your results.

With the given parameter, the program converged after 18 iterations. And I construct this power flow diagram. The total line loss is reaching 27.452 MVA.

According to the simulation both of my hand calculation for first and second iteration were wrong. And unfortunately, I still do not understand the cause.

it is possible that I made a rounding error or a simply miscalculation. I will keep trying to find the problem.




```
Press Enter to terminate the iterations and print the results
                    ITERATIVE SOLUTION DID NOT CONVERGE
                    Maximum Power Mismatch = 2.26818
                          No. of Iterations = 2

    Bus  Voltage  Angle     ------Load------     ---Generation---   Injected
    No.  Mag.     Degree      MW       Mvar       MW       Mvar       Mvar

     1   1.025    0.000     0.000     0.000    343.710   75.887     0.000
     2   0.996   -1.965   400.000   200.000      0.000    0.000     0.000
     3   1.031    2.533     0.000     0.000    300.000  150.861     0.000

    Total                 400.000   200.000    643.710  226.747     0.000
```

```
indy
                Power Flow Solution by Gauss-Seidel Method
                   Maximum Power Mismatch = 4
                         No. of Iterations = 1

 Bus  Voltage  Angle     ------Load------     ---Generation---   Injected
 No.  Mag.     Degree      MW       Mvar       MW       Mvar       Mvar

  1   1.025    0.000     0.000     0.000     0.000   92.250     0.000
  2   1.007   -4.556   400.000   200.000     0.000    0.000     0.000
  3   1.030   -0.426     0.000     0.000   300.000  117.420     0.000

 Total                 400.000   200.000   300.000  209.670     0.000
```