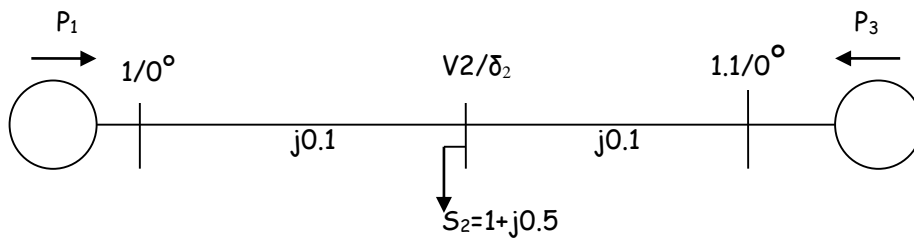


### Load Flow Analysis

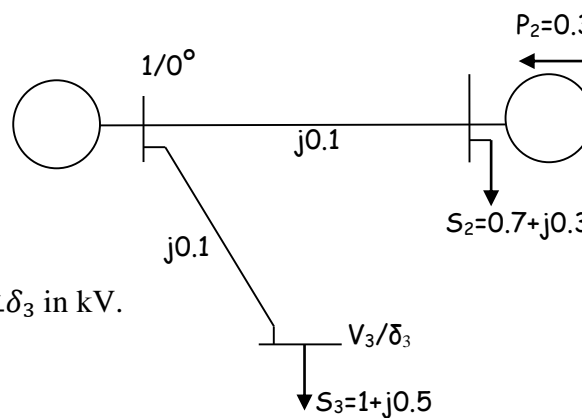
#### Exercise 1

Let the network in the figure below.



Calculate  $V_2$  in  $pu$  and  $\delta_2$  in degrees, then determine  $P_1$  and  $P_3$  in MW. The base power is  $S_b = 100 MVA$ .

#### Exercise 2



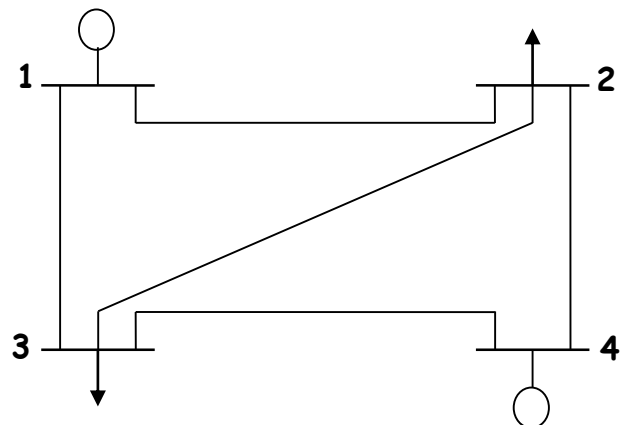
$S_b = 100MVA$ .  $U_b = 138kV$ .

Determine  $V_2 = 1 \angle \delta_2$  and  $V_3 = V_3 \angle \delta_3$  in kV.

#### Exercise 3

Consider the one-line diagram of a 4-bus power network represented in the figure below. The line impedances are given in the table in  $pu$ .

Ligne	$R (pu)$	$X (pu)$
1-2	0.05	0.15
1-3	0.10	0.30
2-3	0.15	0.45
2-4	0.10	0.30
3-4	0.05	0.15



Form the nodal admittance matrix  $Y_{bus}$ .

Given the following complex powers injected at the buses (in  $pu$ ):

$$\bar{S}_2 = -0.5 - j0.2, \quad \bar{S}_3 = -1 + j0.5, \quad \bar{S}_4 = 0.3 - j0.1$$

and the voltage at bus 1:  $\bar{V}_1 = 1.04 \angle 0^\circ$ .

Determine the value of  $V_2$  obtained at the first iteration of the Gauss-Seidel algorithm.

**Exercise 4**

Consider a 3-bus power system whose data are gathered in Tables 1 and 2. The base power is  $S_b = 100 \text{ MVA}$ .

1. Form the nodal admittance matrix  $Y$ .
2. Using the Gauss–Seidel method, determine the voltages at buses 2 and 3 at the first iteration.
3. Determine the active and reactive powers of the slack bus after the first iteration.

Table 1: Scheduled generation and load and assumed voltages

Bus	Assumed voltage	Generation		Load	
		MW	MVAr	MW	MVAr
1 (slack bus)	$1.05+j0.0$	-	-	0	0
2	$1+j0.0$	0.0	0.0	305	140
3	$1+j0.0$	0.0	0.0	138	45

Table 2 : Impédances des lignes

Line	Impédance
1-2	$0.02+j0.04$
1-3	$0.01+j0.03$
2-3	$0.0125+j0.025$

**Exercise 5**

$S_b = 100 \text{ MVA}$ .  $U_b = 138 \text{ kV}$ .

$V_1 = 1 \text{ pu}$  ;  $V_2 = 0.95 \text{ pu}$  ;  $V_3 = 1.05 \text{ pu}$  ;

$\delta_1 = 0^\circ$  ;  $P_2 = P_1$

Determine the angles  $\delta_2$  and  $\delta_3$  using the Newton–Raphson method.

Compute the value of  $Q$ .

