Shahjalal University of Science and Technology (SUST)

Department of Electrical and Electronic Engineering (EEE)

Experiment name: Computing Bus Admittance Matrix Y bus.

Experiment No: 03

Course Title: Power System -I
Course Code: EEE -326

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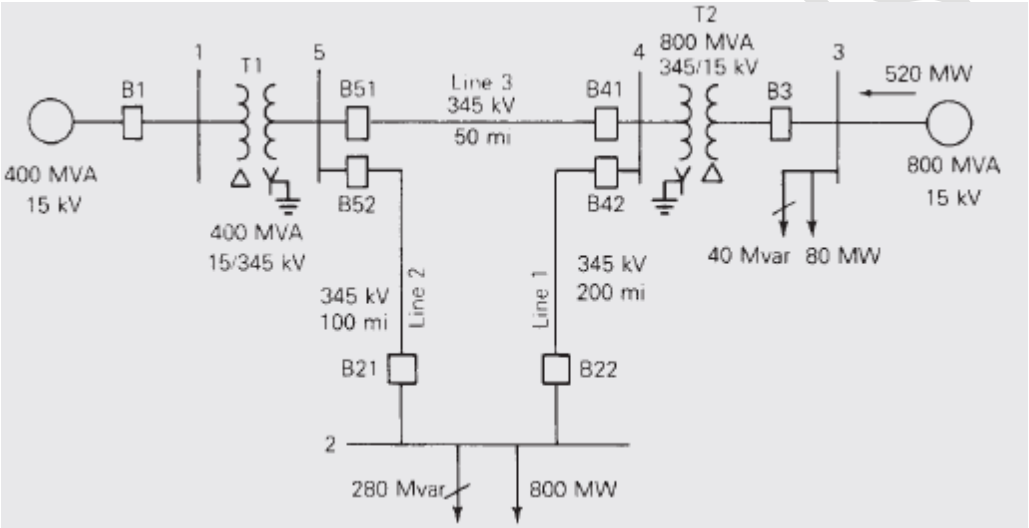
Objective: To compute the Bus Admittance Matrix (Y_{bus})

Equipment: Power World Simulator v17

Procedure:

Following figure shows a single-line diagram of a five-bus power system. Input data are given in Tables 1, 2, and 3. As shown in Table 1, bus 1, to which a generator is connected, is the swing bus. Bus 3, to which a generator and a load are connected, is a voltage-controlled bus. Buses 2, 4, and 5 are load buses.



The input data and unknowns are listed in Table 4. For bus 1, the swing bus, P1 and Q1 are unknowns. For bus 3, a voltage-controlled bus, Q3 and d3 are unknowns. For buses 2, 4, and 5, load buses, V2, V4, V5 and d2, d4, d5 are unknowns.

The elements of Ybus are computed from the equation described in class. Since buses 1 and 3 are not directly connected to bus 2,

$Y21 = Y23 = 0$

Where, half of the shunt admittance of each line connected to bus 2 is included in Y22 (the other half is located at the other ends of these lines).

Now Compute the Bus Admittance Matrix by hand

Bus Admittance Matrix on Power World:

To view the input data, first click on the **Edit Mode** button (on the far left-hand side of the ribbon) to switch into the Edit mode (the Edit mode is used for modifying system parameters). Then by selecting the **Case Information tab** you can view tabular displays showing the various parameters for the system. For example, **use Network, Buses** to view the parameters for each **bus, and Network, Lines and Transformers** to view the parameters for the transmission lines and transformers. Fields shown in **blue** can be directly changed simply by typing over them, and those shown in **green** can be toggled by clicking on them. Note that the values shown on these displays match the values from Tables 1 to 3, except the power values are shown in actual MW/Mvar units. The elements of **Ybus** can also be displayed by selecting **Solution Details**, **Ybus**. Since the Ybus entries are **derived** from other system parameters, they **cannot** be changed directly. Notice that several of the **entries are blank**, indicating that there is **no line directly connecting these two buses** (**a blank entry is equivalent to zero).** For larger networks most of the elements of the Ybus are zero since any single bus usually only has a few incident lines. The elements of the Ybus can be **saved in a Matlab** compatible format by first **right-clicking** within the **Ybus matrix** to display the local menu, and then selecting Save Ybus in Matlab Format from the local menu.

Finally, notice that no flows are shown on the one-line because the nonlinear power-flow equations have not yet been solved. We cover the solution of these equations next.

Bus	Type	V per unit	δ degrees	P_G per unit	Q_G per unit	P_L per unit	Q_L per unit	Q_{Gmax} per unit	Q_{Gmin} per unit
1	Swing	1.0	0	—	—	0	0	—	—
2	Load	—	—	0	0	8.0	2.8	—	—
3	Constant voltage	1.05	—	5.2	—	0.8	0.4	4.0	−2.8
4	Load	—	—	0	0	0	0	—	—
5	Load	—	—	0	0	0	0	—	—

* S_{base} = 100 MVA, V_{base} = 15 kV at buses 1, 3, and 345 kV at buses 2, 4, 5

.Table:1 (Bus input data)

Bus-to-Bus	R′ per unit	X′ per unit	G′ per unit	B′ per unit	Maximum MVA per unit
2–4	0.0090	0.100	0	1.72	12.0
2–5	0.0045	0.050	0	0.88	12.0
4–5	0.00225	0.025	0	0.44	12.0

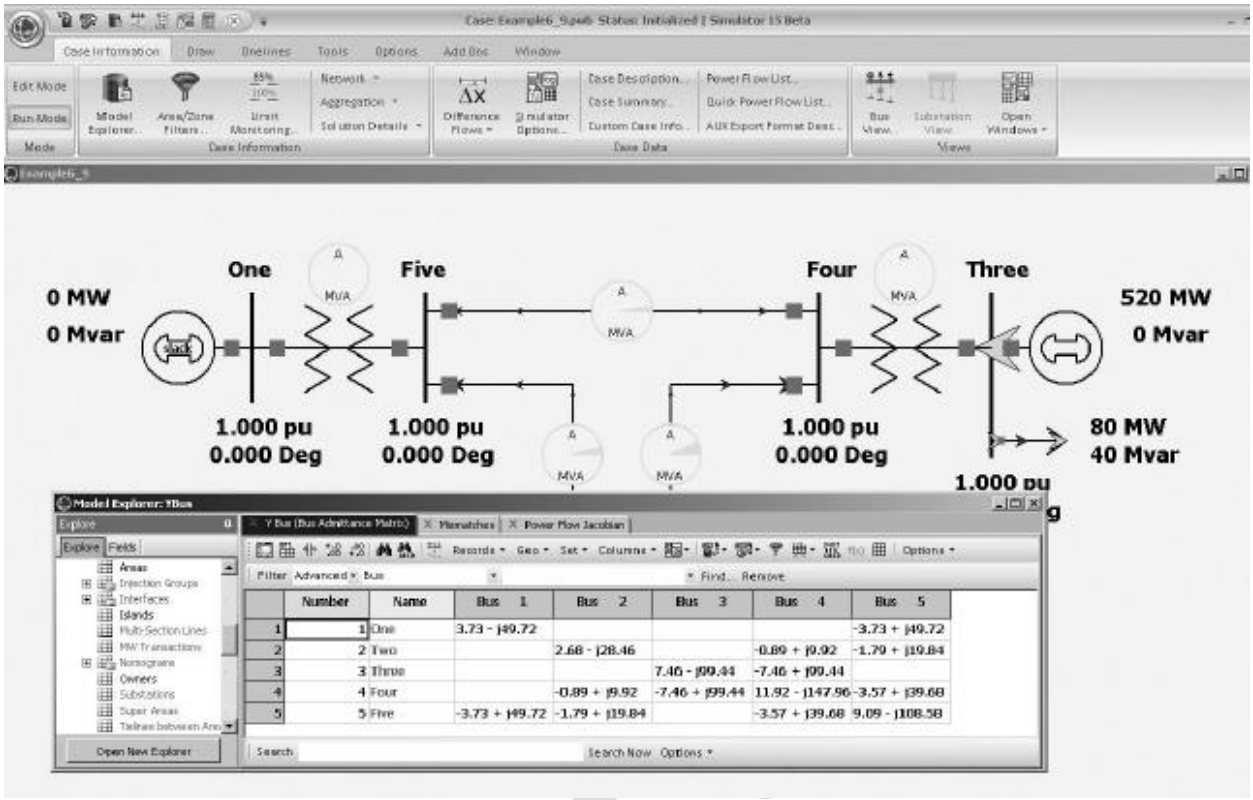
Table:2 (Line input data)

Bus-to-Bus	R per unit	X per unit	G_c per unit	B_m per unit	Maximum MVA per unit	Maximum TAP Setting per unit
1–5	0.00150	0.02	0	0	6.0	—
3–4	0.00075	0.01	0	0	10.0	—

Table:3 (Transformer input data)

Bus	Input Data	Unknowns
1	$V_1 = 1.0, \delta_1 = 0$	P_1, Q_1
2	$P_2 = P_{G2} - P_{L2} = -8$ $Q_2 = Q_{G2} - Q_{L2} = -2.8$	V_2, δ_2
3	$V_3 = 1.05$ $P_3 = P_{G3} - P_{L3} = 4.4$	Q_3, δ_3
4	$P_4 = 0, Q_4 = 0$	V_4, δ_4
5	$P_5 = 0, Q_5 = 0$	V_5, δ_5

Table:4 (Input data and unknowns)



Match the Ybus values those are derived by you and those are calculated using Power World.