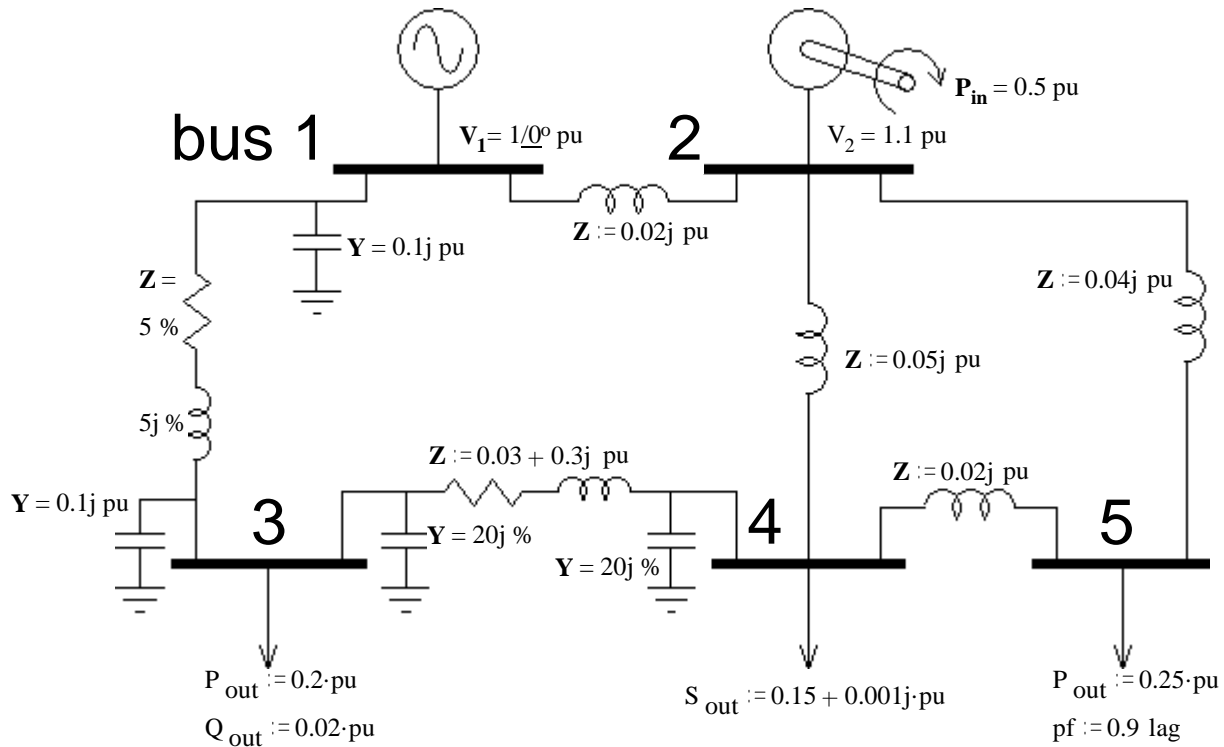


1. Consider the small power system shown below. Values shown are per-unit. (Note: % = 0.01pu)



a) Identify each bus as "slack", "load", or "generator".

bus 1. \_\_\_\_\_ 2. \_\_\_\_\_ 3. \_\_\_\_\_ 4. \_\_\_\_\_ 5. \_\_\_\_\_

b) Show  $V_2$ ,  $V_3$ ,  $V_4$  and  $V_5$  on the drawing (as letters, not values).

c) Show  $I_1$ ,  $I_2$ ,  $I_3$ ,  $I_4$  and  $I_5$  on the drawing and draw arrows to indicate the direction of each.

d) What is the 5x5 matrix shown below called? \_\_\_\_\_

$$\begin{bmatrix} I_1 \\ I_2 \\ I_3 \\ I_4 \\ I_5 \end{bmatrix} = \begin{bmatrix} \_ & \_ & \_ & \_ & \_ \\ \_ & \_ & \_ & \_ & \_ \\ \_ & \_ & \mathbf{A} & \mathbf{B} & \_ \\ \_ & \_ & \_ & \_ & \_ \\ \_ & \_ & \_ & \_ & \_ \end{bmatrix} \cdot \begin{bmatrix} V_1 \\ V_2 \\ V_3 \\ V_4 \\ V_5 \end{bmatrix}$$

e) A number of the elements of the matrix above are zero (0). Fill in all the zero elements.

f) Find elements **A** and **B** in the matrix above.

**Answers**

a) slack generator load load load

d) Admittance, Bus, or  
Bus admittance matrix

e) 
$$\begin{bmatrix} \text{---} & \text{---} & \text{---} & 0 & 0 \\ \text{---} & \text{---} & 0 & \text{---} & \text{---} \\ \text{---} & 0 & \mathbf{A} & \mathbf{B} & 0 \\ 0 & \text{---} & \text{---} & \text{---} & \text{---} \\ 0 & \text{---} & 0 & \text{---} & \text{---} \end{bmatrix}$$

f)  $10.33 - 13j$  pu       $-0.33 + 3.3j$  pu

b) c)

