

Name: _____

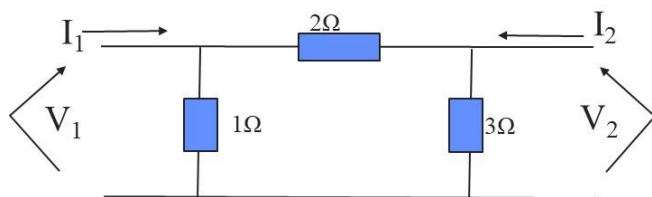
Quiz 9, EE 303, Spring 2019, Dr. McCalley, Closed notes, book, no calculator

A. The Y-parameters characterizing a 2-port network are given by $\begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} y_{11} & y_{12} \\ y_{21} & y_{22} \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \end{bmatrix}$.

1. (20 pts) Develop the expression that shows how to obtain y_{21} from the 2-port in a laboratory environment.

$$I_2 = y_{21}V_1 + y_{22}V_2 \rightarrow y_{21} = \frac{I_2 - y_{22}V_2}{V_1} \rightarrow y_{21} = \left. \frac{I_2}{V_1} \right|_{V_2=0}$$

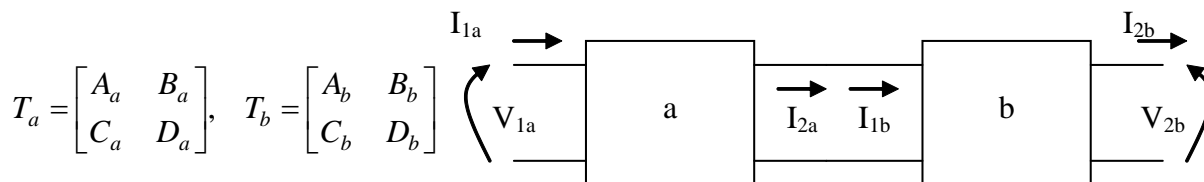
2. (20 pts) Obtain y_{21} for the network shown below.



$$\left. \frac{V_1}{I_2} \right|_{V_2=0} = -2$$

$$\Rightarrow \left. \frac{I_2}{V_1} \right|_{V_2=0} = \frac{-1}{2} = y_{21}$$

B. The two interconnected two-port networks shown below are characterized by ABCD parameters T_a, T_b .



- (15 pts) Express V_{1a} and I_{1a} as a function of V_{2b} and I_{2b} .
- (15 pts) Express the % voltage regulation in terms of V_{1a} and V_{2b} .

Solution:

$$1. \begin{bmatrix} V_{1a} \\ I_{1a} \end{bmatrix} = \begin{bmatrix} A_a & B_a \\ C_a & D_a \end{bmatrix} \begin{bmatrix} A_b & B_b \\ C_b & D_b \end{bmatrix} \begin{bmatrix} V_{2b} \\ I_{2b} \end{bmatrix}$$

2. Voltage regulation is given by:

$$\% \text{ Reg } = \frac{V_{1a} - V_{2b}}{V_{1a}}$$

C. An industrial facility has a load of 1 MW of lighting and motor load of 5 MW and 6 MVAR.

1. (15 pts) Determine the power factor of the entire industrial facility.

$$S_L = 6 + j6 \rightarrow \theta = \tan^{-1}(6/6) = 45^\circ$$

$$\text{pf} = \cos(45) = 0.707$$

2. (15 pts) Determine the amount of reactive power, in MVAR, necessary to correct the power factor to 1.0 lagging.

$$Q=6 \text{ MVARs}$$