EELE 250: Circuits, Devices, and Motors

Lecture 7

Assignment Reminder

- Read 3.1 - 3.3
- Practice problems:
  - **T2.2, T2.4, T2.5**
  - **P3.6, P3.9, P3.24**
- D2L Quiz #3 *by 11AM* on Monday 16 Sept.
- **Exam #1 in class on Wednesday 18 Sept.** Closed book. One 8.5"x11" sheet of handwritten notes. Pencil. Calculator.
- **Special review/problem session: Thursday, Sept. 12, 4:00PM, Cobleigh 608**

Impedance Matching

- Write expressions for the electrical power delivered by the voltage source and consumed by the resistors:

$R_1 = 20\ \Omega$

$50\ V$

$R_2 = 5\ \Omega$
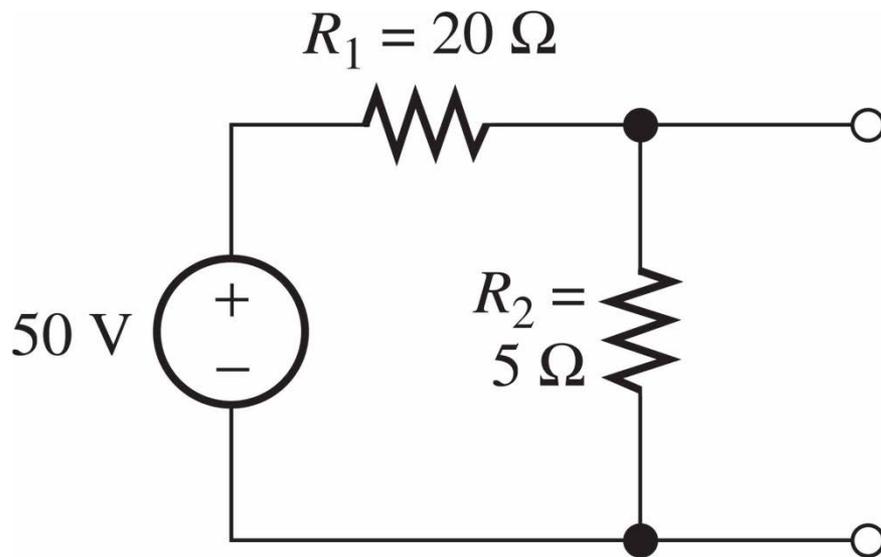
$$P_{source} = \frac{V^2}{R} = \frac{50^2}{25}$$
$$= 100W$$

$$P_{R1} = I^2R = 20\left(\frac{50}{25}\right)^2$$
$$= 80W$$

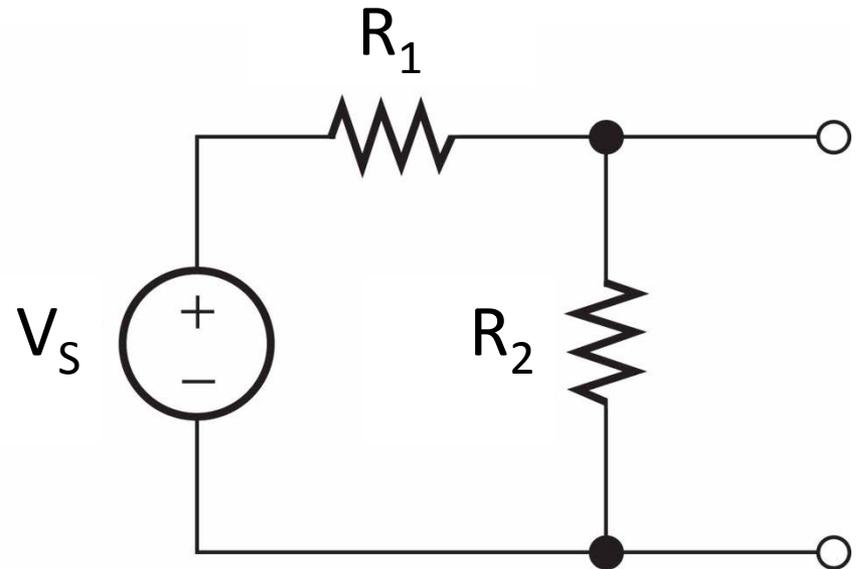$$P_{R2} = I^2R = 5\left(\frac{50}{25}\right)^2$$
$$= 20W$$

Impedance Matching (cont.)

- What value of R_2 results in the maximum amount of power delivered to R_2?

- $P_{R2} = \left(\dfrac{V_S}{R_1 + R_2}\right)^2 \cdot R_2$

- $\dfrac{dP}{dR_2} =$

- Set equal to zero and solve for R_2

Impedance Matching (cont.)

- Maximum power transfer is obtained when load resistance is equal to the Thévenin resistance of the circuit

- In some situations we need *maximum voltage transfer* or *maximum current transfer* instead of maximum power transfer. This typically requires the use of active amplifier circuits.

Linearity and Superposition

- Circuits with linear elements (like resistors and fixed voltage and current sources) result in linear equations to solve

- Linear equations obey the *scaling* principle and the *superposition* principle

- We can use superposition to simplify the solution of circuits with more than one independent voltage or current source

Summary and Review

- Source transformation by equivalent Thévenin and Norton circuits

- Maximum power transfer occurs with a matched impedance ($R_L = R_t$)

- Superposition can be used to simplify solution of multi-source circuits by treating the sources one at a time and then adding up the result