

EELE 250: Circuits, Devices, and Motors

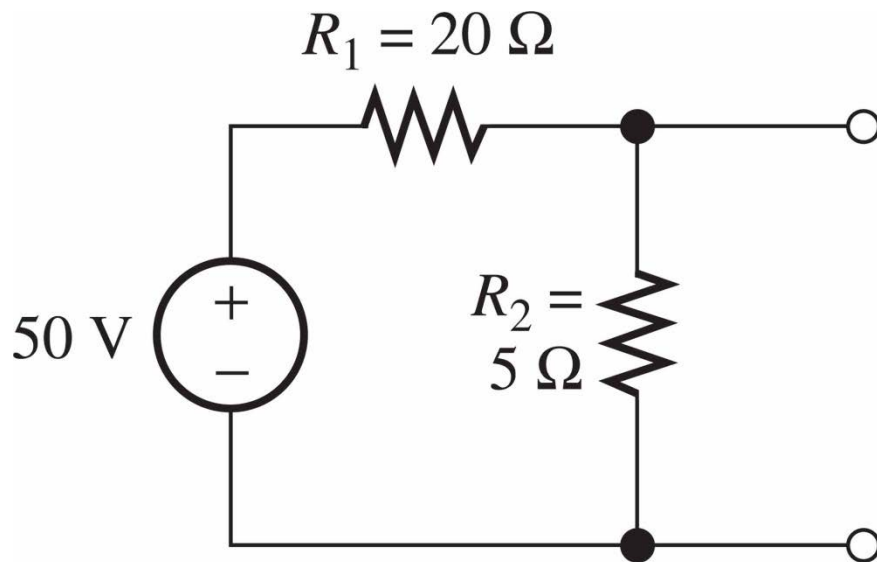
Lecture 7

Assignment Reminder

- Read 3.1 - 3.3
- Practice problems:
 - P2.69, P2.72, 2.77, 2.80, 2.81, 2.83
 - P2.94, 2.97
- D2L Quiz #3 *by 11AM on Monday 19 Sept.*
- Exam #1 in class on Monday 19 Sept.
Closed book. One 8.5"x11" sheet of handwritten notes. Pencil. Calculator.

Impedance Matching

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



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

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

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

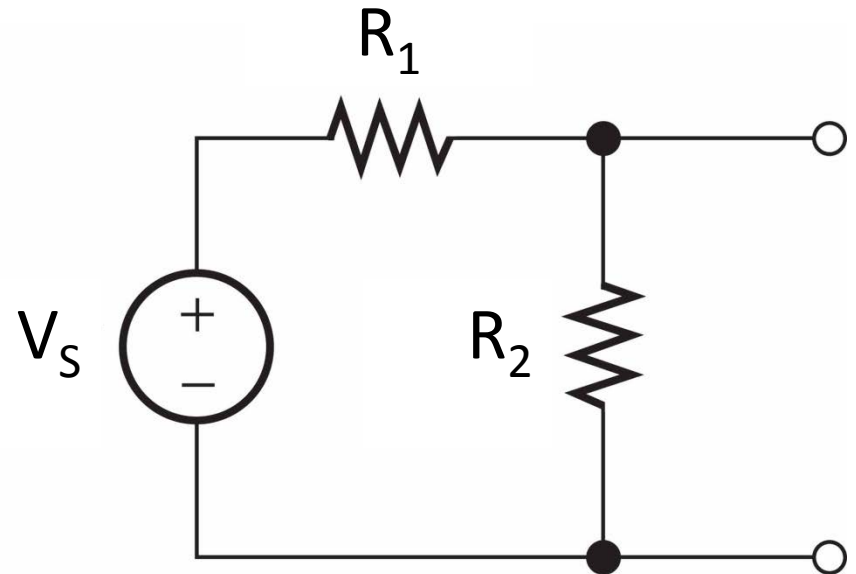
Impedance Matching (cont.)

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

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

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

- 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