

Electrical Circuit (1)

Linearity circuit (week7 class1)

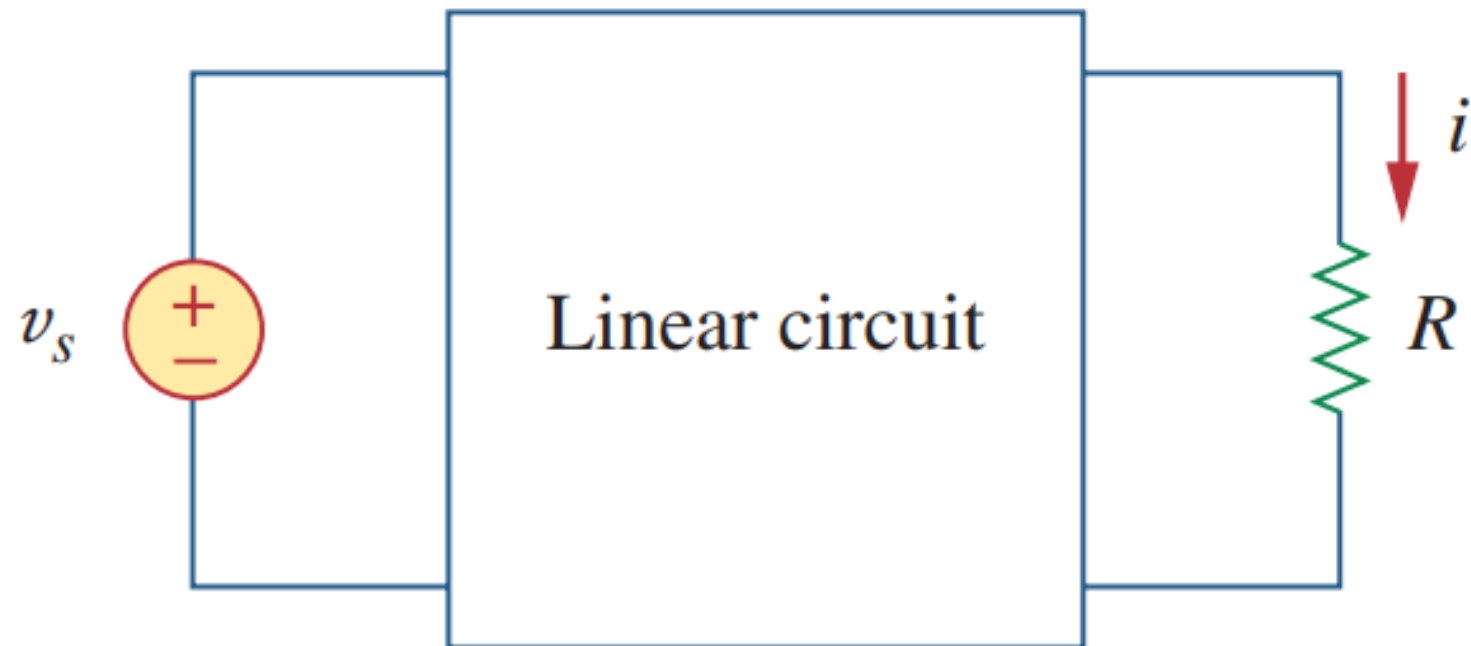
Dr. Akram Al-Mahrouk

Philadelphia University

Chapter 4 Circuit Theorems 127

- 4.1 Introduction 128
- 4.2 Linearity Property 128
- 4.3 Superposition 130
- 4.4 Source Transformation 135
- 4.5 Thevenin's Theorem 139
- 4.6 Norton's Theorem 145
- 4.7 †Derivations of Thevenin's
and Norton's Theorems 149
- 4.8 Maximum Power Transfer 150
- 4.9 Verifying Circuit Theorems
with *PSpice* 152
- 4.10 †Applications 155
 - 4.10.1 Source Modeling
 - 4.10.2 Resistance Measurement
- 4.11 Summary 160
 - Review Questions 161
 - Problems 162
 - Comprehensive Problems 173

Linearity Property



Linearity Property

For the circuit find I_o when $v_s = 12\text{ V}$ and $v_s = 24\text{ V}$.

Basic equation

$$(6 * i_1) + (2 * i_1) + 4 * (i_1 - i_2) + 12 = 0$$

$$-12 + 4 * (i_2 - i_1) + (8 * i_2) + (4 * i_2) - 3(2 * i_1) = 0$$

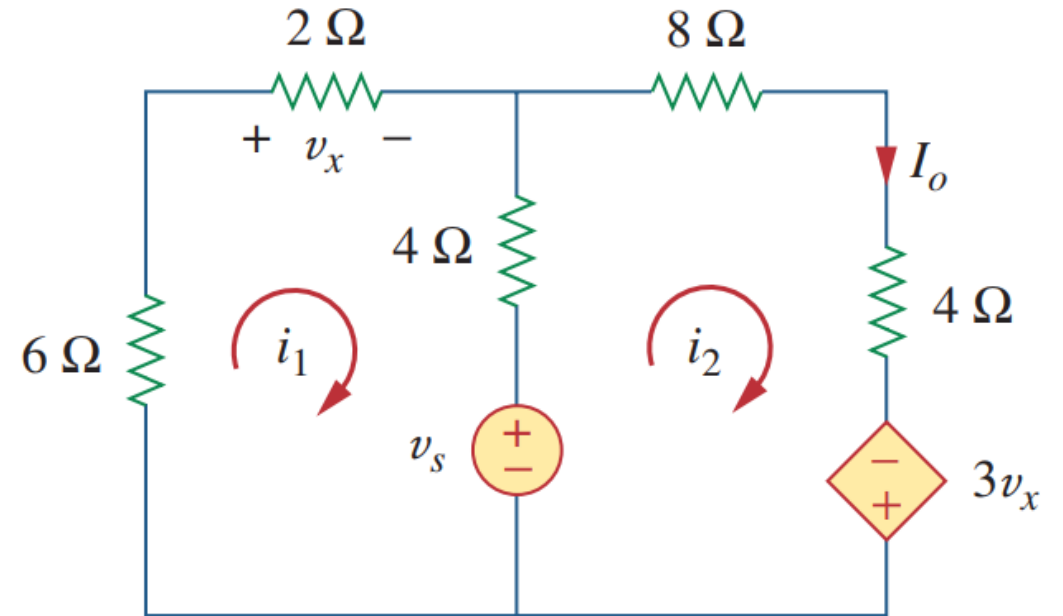
Formulated equation

$$12i_1 - 4i_2 = -12$$

$$-10i_1 + 16i_2 = 12$$

Final answer @ $V_s = 12\text{V}$

$$i_1 = \frac{-18}{19}\text{ A} \quad i_2 = \frac{3}{19}\text{ A}$$



Final answer @ $V_s = 24\text{V}$

$$i_1 = \frac{-32}{19}\text{ A} \quad i_2 = \frac{6}{19}\text{ A}$$

Linearity Property

For the circuit find v_o when $i_s = 30$ and $i_s = 45$ A.

@ $i_s = 30$

$$i_o = i_s \frac{4}{12 + 8} = 30 \frac{4}{12 + 8 + 4} = 5A$$

$$v_o = 5 * 8 = 40V$$

@ $i_s = 45$

$$\frac{i_{s,new}}{i_{s,old}} = \frac{v_{o,new}}{v_{o,old}}$$

$$v_{o,new} = v_{o,old} \frac{i_{s,new}}{i_{s,old}} = 40 \frac{45}{30} = 60V$$

