Topic 3 recap

- Superposition principle in linear circuits (circuit analysis).
  - The response of a linear circuit (a voltage or current of an element) with multiple sources is the **algebraic sum** of individual responses **due to each independent source** when the rest are **turned off.**
  - **Dependent sources** are **left intact** during all calculations.
- Source transformation (circuit analysis/simplification).
  - Consists in replacing a **voltage source** v_s (independent or dependent) in **series** with a **resistor** with a **current source** i_s (independent or dependent, respectively) in **parallel** with another resistor at the **same terminal** or vise versa.
    - $i_s = \frac{v_s}{R}$ or $v_s = Ri_s$.
    - The transformed resistors are the **same.**
- Thevenin's theorem.
  - A linear circuit can be **replaced** (modelled) with a **voltage source** $\boldsymbol{V_{\mathrm{Th}}}$ in **series** with a **resistor** $\boldsymbol{R_{Th}}$ from a given terminal.
  - V_{Th} is equal to the **open-circuit voltage** across the terminals ($V_{\mathrm{Th}} = v_{oc}$).
  - R_{Th} is obtained as:
    - Ratio of the open-circuit voltage to the short-circuit current at the terminal pair.
    - **Input resistance** measured at the terminal pair when **all independent sources** are **turned off** (note that this method cannot be used for dependent sources).

Topic 3 recap

- Norton's theorem.
  - A linear circuit can be **replaced** (modelled) with a **current source $\boldsymbol{I_N}$** in **parallel** with a **resistor $\boldsymbol{R_N}$** from a given terminal.
  - I_N is equal to the **short-circuit current** at the terminals ($I_N = i_{sc}$).
  - R_N is the **same** as R_{Th}.
- Thevenin-Norton transformation is exactly the **same** as **source transformation**.
  - $V_{\mathrm{Th}} = R_N I_N$ or $I_N = \frac{V_{\mathrm{Th}}}{R_{\mathrm{Th}}}$
  - $R_{\mathrm{Th}} = R_N = \frac{v_{\mathrm{oc}}}{i_{\mathrm{sc}}}$
- Maximum power transfer
  - If $\boldsymbol{R_L = R_{Th}}$ the power transferred to the load $\mathrm{R_L}$ is maximum.
  - $\boldsymbol{p_{max} = \frac{{V_{Th}}^2}{4R_{Th}}}$
  - $v_L = \frac{V_{\mathrm{Th}}}{2}$