Georgia Institute of Technology


# Linear Circuits

**Nathan V. Parrish**
PhD Candidate & Graduate Research Assistant
School of Electrical and Computer Engineering

*An introduction to linear electric circuit elements and a study of circuits containing such devices.*

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# Linear Model of Transformers

**Nathan V. Parrish**
PhD Candidate & Graduate Research Assistant
School of Electrical and Computer Engineering

*Present linear model for analyzing transformers.*

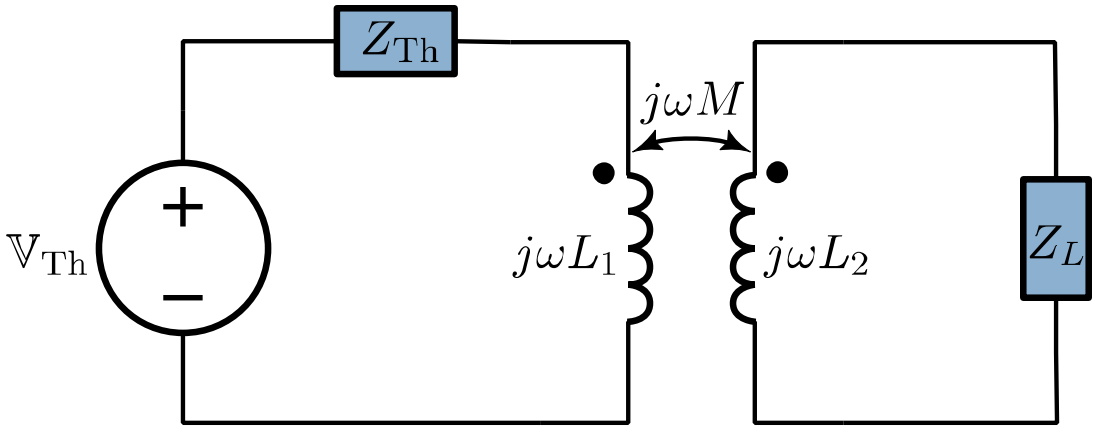
# Previous Lesson

- Introduced transformers and how they work
- Identified some analysis models which exist for transformers

# Lesson Objectives

- Identify the linear model of transformers
- Use circuit analysis to analyze the behavior of a transformer system
- Apply this analysis to solving a transformer circuit problem

# Linear Transformer



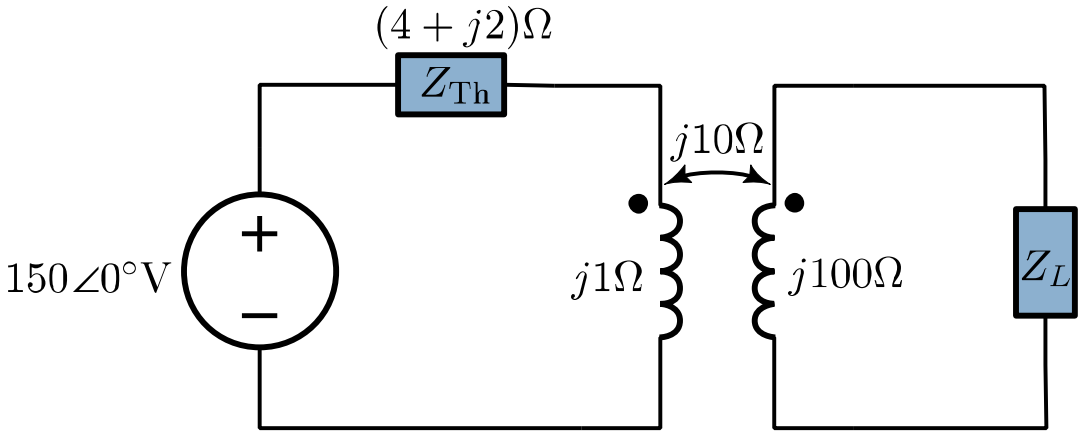

$$\mathbb{V}_{\text{Th}} = (Z_{\text{Th}} + j\omega L_1)\mathbb{I}_1 - j\omega M\mathbb{I}_2$$
$$0 = (Z_L + j\omega L_2)\mathbb{I}_2 - j\omega M\mathbb{I}_1$$

$$\mathbb{I}_1 = \frac{Z_L + j\omega L_2}{(Z_{\text{Th}} + j\omega L_1)(Z_L + j\omega L_2) + \omega^2 M^2}\mathbb{V}_{\text{Th}}$$

$$Z_{\text{eq}} = \frac{\mathbb{V}_{\text{Th}}}{\mathbb{I}_1} = Z_{\text{Th}} + j\omega L_1 + \frac{\omega^2 M^2}{Z_L + j\omega L_2}$$

Reflected impedance

# Transformer Example




$$\mathbb{I}_1 = \frac{Z_L + j\omega L_2}{(Z_{\text{Th}} + j\omega L_1)(Z_L + j\omega L_2) + \omega^2 M^2}\mathbb{V}_{\text{Th}}$$

$$\mathbb{I}_2 = \frac{j\omega M}{(Z_{\text{Th}} + j\omega L_1)(Z_L + j\omega L_2) + \omega^2 M^2}\mathbb{V}_{\text{Th}}$$

# Summary

- Presented the linear model
- Derived the phenomenon of reflected impedance
- Used circuit analysis to analyze an example transformer circuit

# Next Lesson

- Ideal transformer model