ELEC 344 - 201: Applied Electronics and Electromechanics

Instructor: Ignacio Galiano Zurbriggen
TAs: Daniel Hsu, Abbas Arshadi, Matthieu Amyotte, Jorge May

Tutorial 4

1) Using the magnetic circuit in Figure 1:

   - $\boldsymbol{l_1 = 6cm; l_2 = 4cm; l_3 = 2.75cm; l_{ag} = 0.5cm}$
   - The core is of uniform thickness, $\boldsymbol{t = 2cm}$
   - The width of branch $\boldsymbol{l_1 = 2cm}$
   - The width of branches $\boldsymbol{l_2, l_3}$ and $\boldsymbol{l_{ag} = 1cm}$
   - Iron core $\boldsymbol{\mu_r = 5000}$; Air gap $\boldsymbol{\mu_r = 1}$; $\boldsymbol{\mu_0 = 4\pi * 10^{-7}}$
   - $\boldsymbol{V = 10V; R = 0.1\Omega; N = 1000}$

   a) Determine the total reluctance of the magnetic circuit $\boldsymbol{R_{tot}}$.

   b) What is the total magnetic flux $\boldsymbol{\phi}$ induced in the magnetic circuit?

   c) What happens when the inductor's saturation current is exceeded?

   d) What considerations should be made to ensure the magnetic core does not saturate?

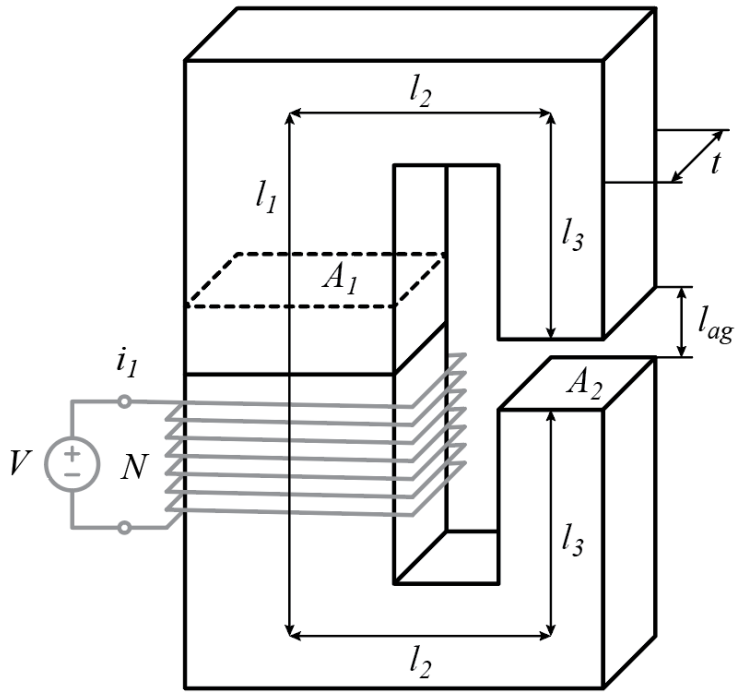

Figure 1 – Example Magnetic Circuit

Figure 2 illustrates the real transformer model derived in class.

a) Using the ammeter (A), voltmeter (V) and wattmeter (W) measurements determine $\boldsymbol{L_m}$ and $\boldsymbol{R_c}$ using the *Open Circuit Test*. What assumptions are made? Are there any special considerations needed to be taken into account?

b) Using the ammeter (A), voltmeter (V) and wattmeter (W) measurements determine $\boldsymbol{L_{l1}, L'_{l2}, r_1}$ and $\boldsymbol{r'_2}$ using the *Short Circuit Test*. What assumptions are made? Are there any special considerations needed to be taken into account?

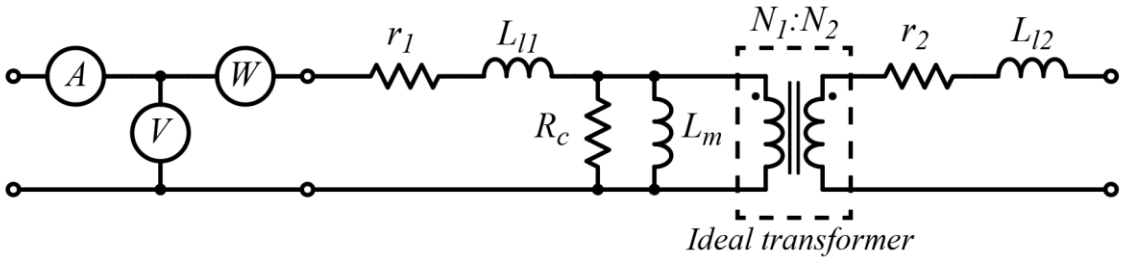

Figure 2 – Real Transformer Model