

# EE160 Lab Assignment-6

Lab section 1A

## Open and Short Circuit Test of a Transformers

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## Objectives:

Perform Open and Short circuit test to find out the value of  $R_C$ ,  $X_M$ ,  $R_{Eq}$ ,  $X_{Eq}$  and Estimate the value of resistance and reactance of the primary and secondary windings respectively, *i.e.*,  $R_P$ ,  $X_P$ ,  $R_S$ ,  $X_S$ .

## Parameters for Open Circuit Test :

Input voltage =  $(7.35 \times 10^5) \cdot \sqrt{2}$  V

Frequency = 50Hz

## Transformer Parameters :

Block Parameters: Linear Transformer

Linear Transformer (mask) (link)

Implements a three windings linear transformer.

Click the Apply or the OK button after a change to the Units popup to confirm the conversion of parameters.

Parameters

Units SI

Nominal power and frequency [Pn(VA) fn(Hz)]:

[ 250e6 50 ]

Winding 1 parameters [V1(Vrms) R1(ohm) L1(H)]:

[ 7.35e+05 4.3218 0.45856 ] [ 7.35e+05, 4.3218, 0.45856 ]

Winding 2 parameters [V2(Vrms) R2(ohm) L2(H)]:

[ 3.15e+05 0.7938 0.084225 ] [ 3.15e+05, 0.7938, 0.084225 ]

☐ Three windings transformer

Winding 3 parameters [V3(Vrms) R3(ohm) L3(H)]:

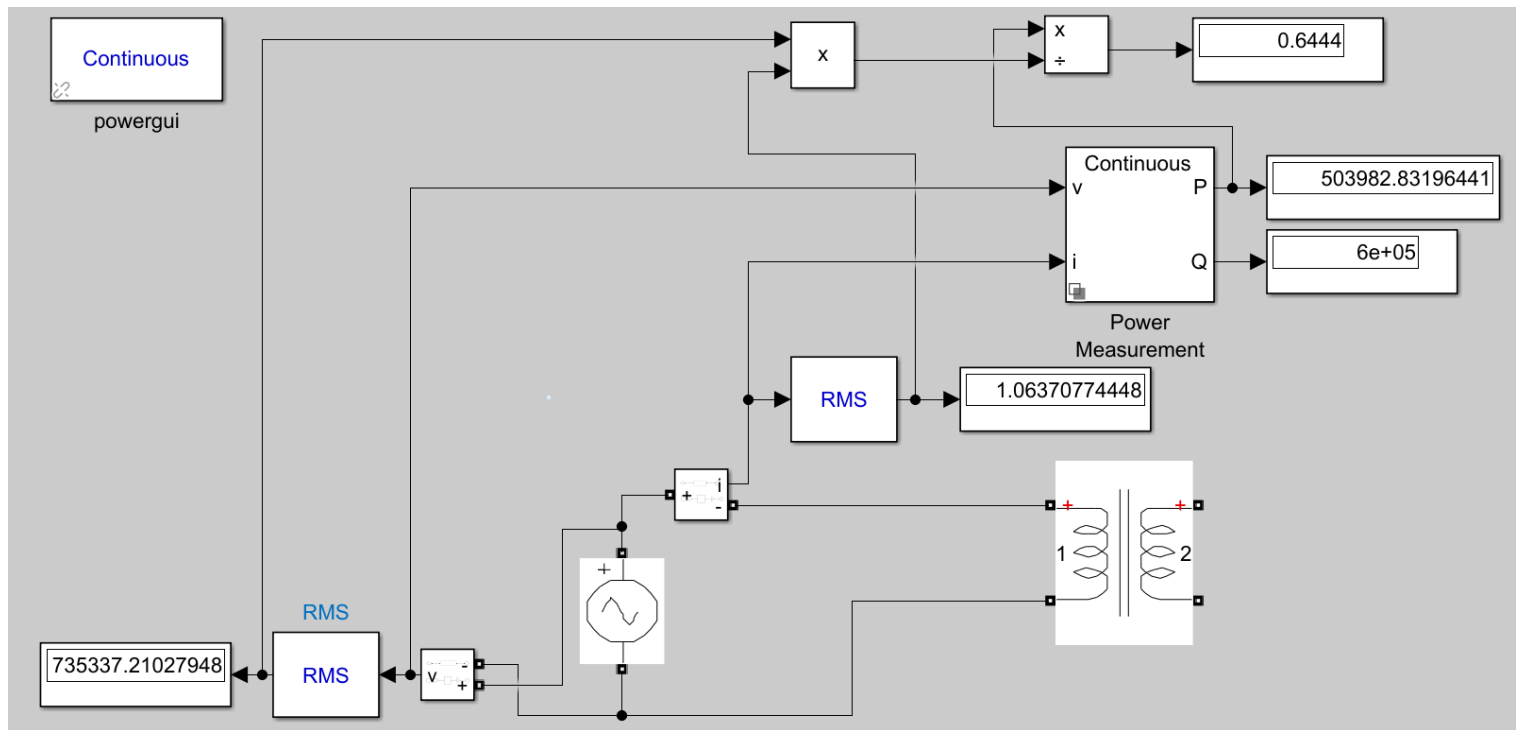
[ 3.15e+05 0.7938 0.084225 ] [ 3.15e+05, 0.7938, 0.084225 ]

Magnetization resistance and inductance [Rm(ohm) Lm(H)]:

[ 1.0804e+06 2866 ] [ 1080400, 2866 ]

Measurements None

## Open Circuit :



$$\text{Power Factor} = \cos \theta = P_{OC} / (V_{OC} \times I_{OC})$$

$$= 0.64432$$

$$\text{Admittance } Y_E = (I_{OC} / V_{OC}) \angle -\theta \text{ mho}$$

$$= 1.4465 \times 10^{-6} \text{ mho}$$

$$= (1/1079951.15) + j (1/903995.66) \text{ mho}$$

$$R_C = 1079951.15 \text{ ohm}$$

$$X_M = 903995.66$$

$$\text{That means } L_M = 903995.66 / 2\pi f = 2877.05 \text{ H}$$

## Verification:

i) Magnetization Resistance ( $R_m$ ) =  $1.0804 \times 10^6$  Ohms (Theoretical)

$R_c = 1.07 \times 10^6$  Ohms (Practical)

ii) Inductance ( $L_m$ ) = 2866 H (Theoretical)

$L_m = 2882.87$  H (Practical)

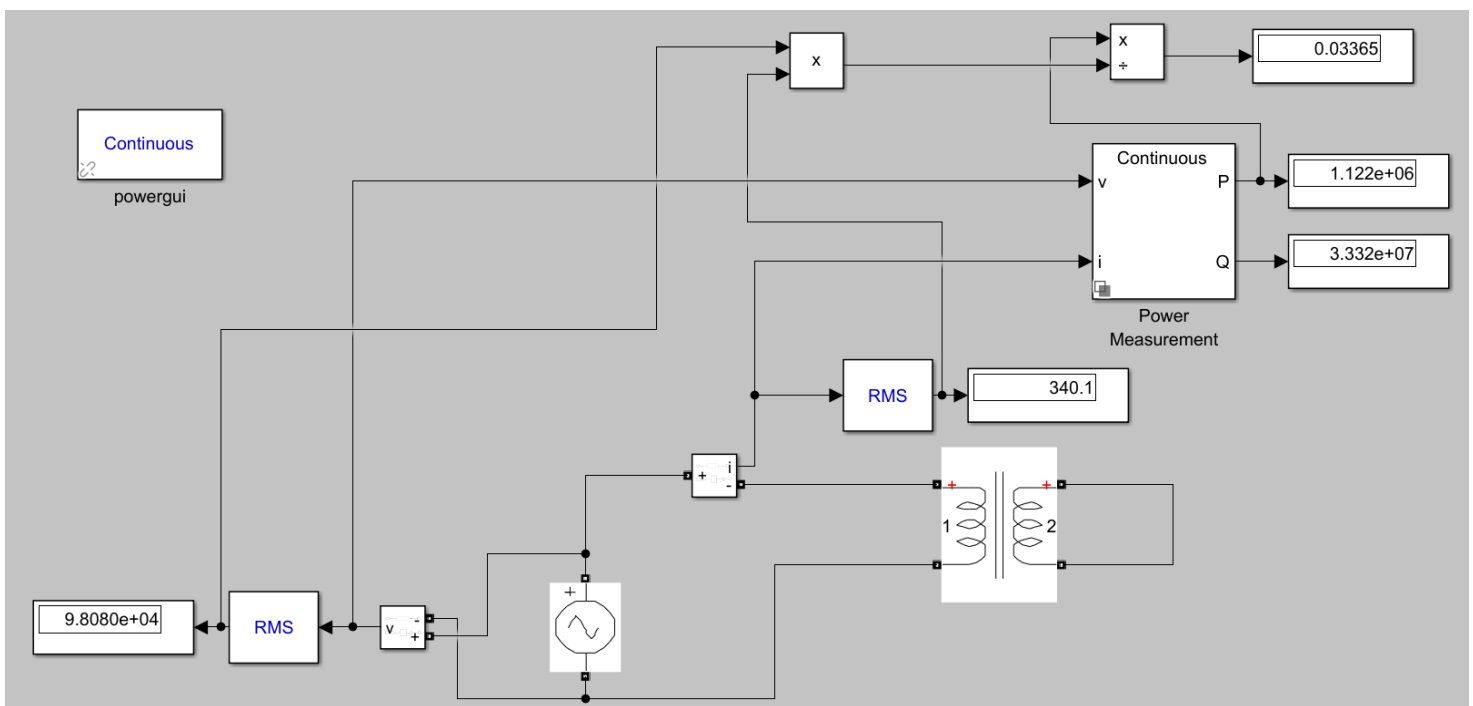
## Parameters for Short Circuit Test :

Input voltage =  $(7.35 \times 10^5) \times \sqrt{2} \times 0.13365$  V

Frequency = 50Hz

(Transformer Parameters are the same as in the previous test.)

## Short Circuit Test :



$$\text{Power Factor} = \cos \theta = P_{sc} / (V_{sc} \times I_{sc})$$
$$= 0.03365$$

$$\theta = 88.0716^\circ$$

$$\text{Impedance } Z_E = (V_{sc} / I_{sc}) \angle \theta \text{ ohm}$$
$$= 288.3857 \text{ ohm}$$
$$= (9.7) + j (288.22) \text{ ohm}$$
$$= R_{Eq} + j X_{Eq} \text{ ohm}$$

$$R_{Eq} = 9.7 \text{ ohm}$$

$$X_{Eq} = 288.22 \text{ ohm}$$

## Verification:

$$R_{eq} = R_p + a^2 \cdot R_s$$

$$R_{eq} = 4.3218 + (2.3333)^2 \cdot 0.7938$$

$$R_{eq} = 8.6435 \text{ Ohms (Theoretical)}$$

$$R_{eq} = 7.86044 \text{ Ohms (Practical)}$$

$$X_{eq} = X_p + a^2 \cdot X_s$$

$$X_{eq} = (0.45856 + (2.3333)^2 \times 0.084225) \times 2\pi f$$

$$X_{eq} = 287.97104 \text{ Ohms (Theoretical)}$$

$$X_{eq} = 288.22617 \text{ Ohms (Practical)}$$

## Conclusions:

1. The practical as well as theoretical values of  $R_C$  and  $X_M$  are approximately equal. Hence, the values found practically are correct.
2. The practical as well as theoretical values of  $R_{eq}$  and  $X_{eq}$  are approximately equal. Hence, the values found practically are correct