AL-IMAM MOHAMMAD IBN SAUD
ISLAMIC UNIVERSITY
EE371 ELECTRIC DRIVES
QUIZ 2

COLLEGE OF ENGINEERING
Electrical Engineering Dept.
Time allowed 50 minutes

SEMESTER 2, APRIL 2017

Quiz Score: /10

إسم الطالب ..... Model Answer .....

Problem I

For the transformer equivalent circuit shown:

turns ratio a= 5, R_1=1.0 Ω X_1=2.0 Ω

R_2=0.08 Ω X_2=0.16 Ω

R_{C1}=300 Ω X_{m1}=150 Ω

$Z_L = 2.5\angle 80^\circ$ Ω.

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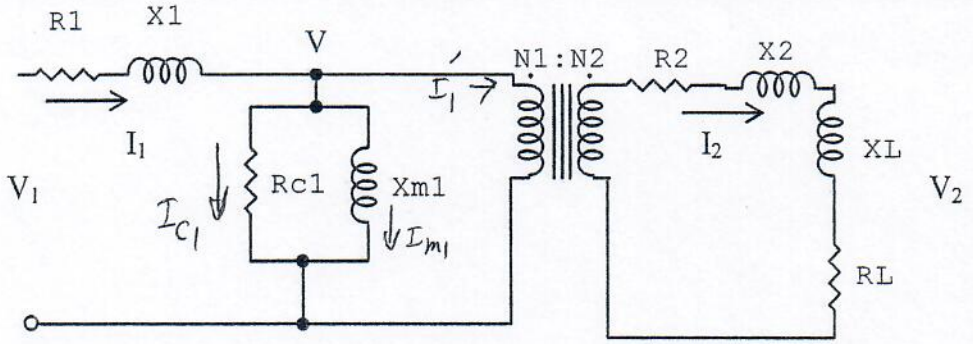
Knowing that V= $1100\angle 0^\circ$ V, find V_1, V_2, I_1, and I_2 and sketch them.



$I_{c_1} = 3.67\angle 0$ A

$I_{m_1} = 7.33\angle -90$ A

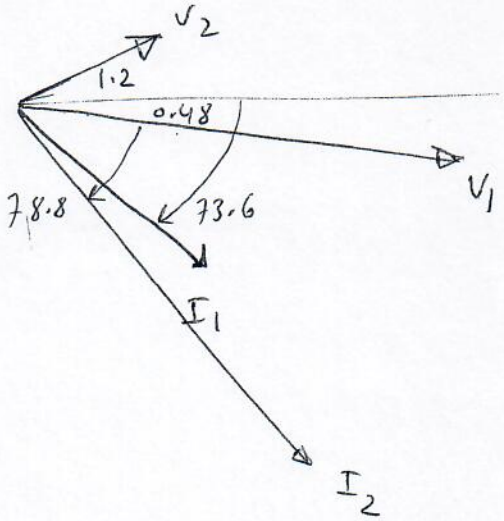
$I_2 = 82.37\angle -78.8$ A

$I_1' = 16.47\angle -78.8$ A

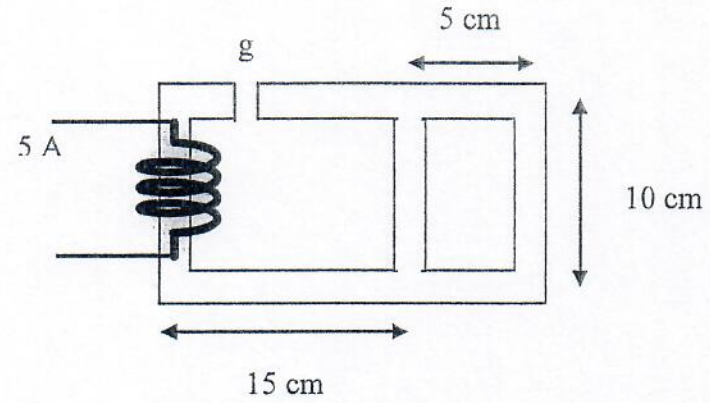
$I_1 = 24.47\angle -73.6$ A

$V_1 = 1153.9\angle -0.48^\circ$ V

$V_2 = 205.9\angle 1.2^\circ$ V

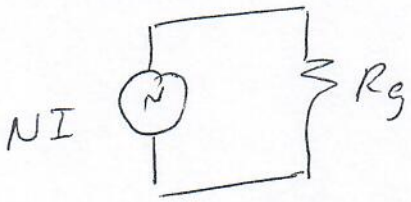


Problem II



The magnetic circuit shown has $\mu_r = 20000$. Find the percentage increase in the total flux if the gap length decreases from 2 mm to 1 mm

neglecting irm reluctance w.r.t air gap reluctance



$$\phi_{t_1} = \frac{NI}{R_{g_1}}$$

$$\phi_{t_2} = \frac{NI}{R_{g_2}}$$

$$\% \text{ increase} = \frac{\phi_{t_2} - \phi_{t_1}}{\phi_{t_1}} * 100$$

$$= \frac{\frac{1}{R_{g_2}} - \frac{1}{R_{g_1}}}{\frac{1}{R_{g_1}}} * 100 = \frac{\frac{1}{l_{g_2}} - \frac{1}{l_{g_1}}}{\frac{1}{l_{g_1}}} * 100$$

$$= \frac{1 - \frac{1}{2}}{\frac{1}{2}} * 100 = 100\ \%$$

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MID II - SEMESTER 2, 1437/1438

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Time allowed 50 minutes
MAY 2017

Exam Score: /20

إسم الطالب ..... Model Answer .....

Open Book

Try the following Problems

Problem I

Two coils, one mounted on a stator and the other on a rotor, have self and mutual inductances given by;

$L_{ss} = 1.0$ H $L_{rr} = 2.5$ H $L_{sr} = M \cos\theta$ H

the coils are connected in series and carry a current

$$i(t) = I_o \sin \omega t \ A$$

The angle between the axes of the coils is θ.

Erratum

When the rotor is held fixed at $\theta = 45°$, the time averaged torque is $30\sqrt{2}$ N.m and then the two coils are separated, rotor coil current remains the same and stator coil is short circuited, and θ is the same, the resultant time averaged torque in this case is 15 N.m. Find M and I_o .

Case (1) $T = -M i_s i_r \sin\theta$

$= -M I_o^2 \sin^2 \omega t \sin\theta$

$T_{av.} = \frac{M I_o^2}{2} \sin\theta = \frac{M I_o^2}{2} \frac{1}{\sqrt{2}} = 30\sqrt{2}$

$M I_o^2 = 120$ (1)

Case (2) Stator S.C $\Rightarrow d_s = L_{ss} i_s + L_{sr} i_r$

$\frac{d d_s}{dt} = 0 \Rightarrow i_s = -M \cos\theta I_o \sin\omega t$

$T = M^2 I_o^2 \sin\theta \cos\theta \sin^2 \omega t \Rightarrow T_{av.} = \frac{M^2 I_o^2}{4} \sin 2\theta$

$= \frac{M^2 I_o^2}{4} = 15$ (2)

from (1) and (2)

$M = 0.5$ H and $I_o = 15.5$ A