1.

The following information is given about the simple rotating loop shown in Figure 7-6:

$B = 0.4$ T $\qquad V_B = 48$ V

$l = 0.5$ m $\qquad R = 0.4\ \Omega$

$r = 0.25$ m $\qquad \omega = 500$ rad/s

(a) Is this machine operating as a motor or a generator? Explain.

(b) What is the current i flowing into or out of the machine? What is the power flowing into or out of the machine?

(c) If the speed of the rotor were changed to 550 rad/s, what would happen to the current flow into or out of the machine?

(d) If the speed of the rotor were changed to 450 rad/s, what would happen to the current flow into or out of the machine?

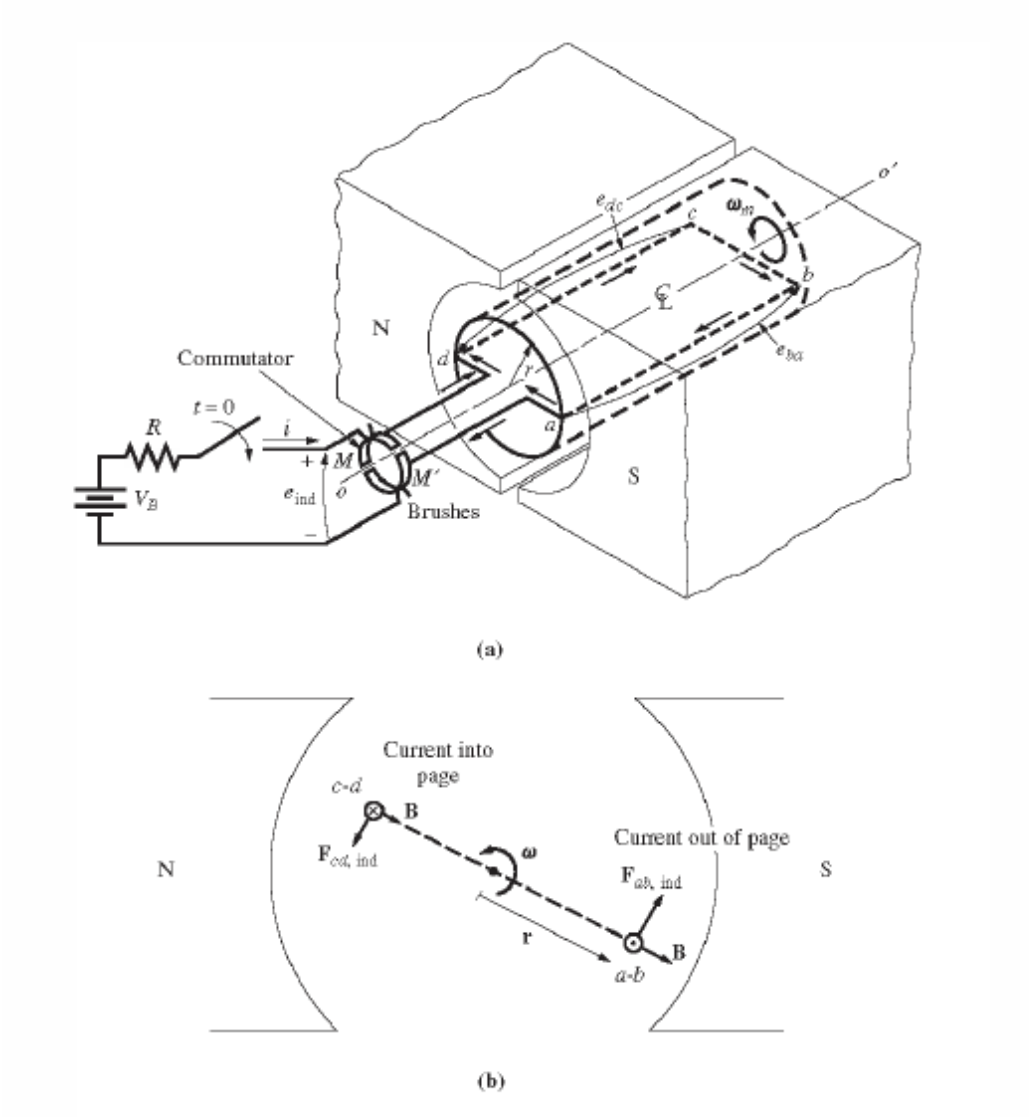


FIGURE 7–6
Derivation of an equation for the induced torque in the loop. Note that the iron core is not shown in part **b** for clarity.

2.

A 208-V six-pole Y-connected 25-hp design class B induction motor is tested in the laboratory, with the following results:

No load:	208 V, 24.0 A, 1400 W, 60 Hz
Locked rotor:	24.6 V, 64.5 A, 2200 W, 15 Hz
Dc test:	13.5 V, 64 A

Find the equivalent circuit of this motor, and plot its torque-speed characteristic curve.

(or write the torque-speed equation instead of plot the figure)

Homework 14

1. (a) $e_{ind} = 2rlBw$
$= 2 \times 0.25 \times 0.5 \times 0.4 \times 500$
$= 50V$

$V_B = 48V \Rightarrow e_{ind} > V_B \therefore$ generator

(b) $i = \frac{e_{ind} - V_B}{R}$
$= \frac{50-48}{0.4}$
$= 5A$

$P = i\, e_{ind}$
$= 5 \times 50$
$= 250W$

(c) $e_{ind}' = 2rlBw$
$= 2 \times 0.25 \times 0.5 \times 0.4 \times 550$
$= 55V$
$\therefore$ generator

$i = \frac{e_{ind} - V_B}{R}$
$= \frac{55-48}{0.4}$
$= 17.5A$

(d) $e_{ind}'' = 2rlBw$
$= 2 \times 0.25 \times 0.5 \times 0.4 \times 450$
$= 45V$
$\therefore$ motor

$i = \frac{V_B - e_{ind}}{R}$
$= \frac{48-45}{0.4}$
$= 7.5A$

2. no load test : $X_1 + X_m = \frac{\frac{208}{\sqrt{3}}}{24} = 5\Omega$

lock-rotor test : $R_{LR} + jX_{LR}' = \frac{\frac{24.6}{\sqrt{3}}}{64.5} = 0.22\Omega$

$\theta_{LR}' = \cos^{-1}\frac{2200}{\sqrt{3} \times 24.6 \times 64.5} = 36.82°$

$R_{LR} = R_1 + R_2 = |Z_{LR}'| \cos\theta_{LR} = 0.22 \times \cos 36.82° = 0.176$

DC test : $R_1 = \frac{1}{2}\frac{13.5}{64}$
$= 0.105\Omega$

$\Rightarrow R_2 = R_{LR} - R_1$
$= 0.176 - 0.105$
$= 0.071\Omega$

$X_{LR}' = |Z_{LR}'| \sin\theta_{LR} = 0.22 \sin 36.82° = 0.528\Omega$

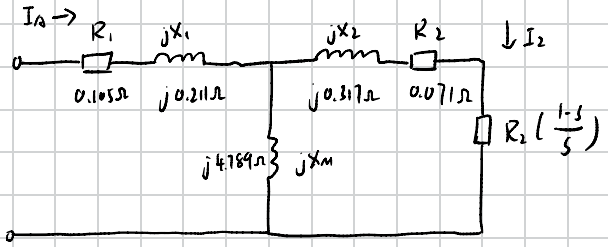
Design Class 13 motor : $X_1 = 0.211\Omega$, $X_2 = 0.317\Omega$

$\therefore X_M = 5 - X_1$

$= 5 - 0.211$

$= 4.789\Omega$

equivalent circuit :



plot :