EE 360: Home Work #4-SOLUTION

7-3. Prove that the equation for the induced voltage of a single simple rotating loop

$$e_{ind} = \frac{2}{\pi}\phi\,\omega \qquad (7\text{-}6)$$

is just a special case of the general equation for induced voltage in a dc machine

$$E_A = K\,\phi\,\omega \qquad (7\text{-}38)$$

SOLUTION From Equation 7-38,

$$E_A = K\,\phi\,\omega$$

where $K = \dfrac{ZP}{2\pi a}$

For the simple rotation loop,

$Z = 2$ (There are 2 conductors)
$P = 2$ (There are 2 poles)
$a = 1$ (There is one current path through the machine)

Therefore,

$$K = \frac{ZP}{2\pi a} = \frac{(2)\ (2)}{2\pi\ (1)} = \frac{2}{\pi}$$

and Equation 7-38 reduces to Equation 7-6.

7-4. A dc machine has 8 poles and a rated current of 120 A. How much current will flow in each path at rated conditions if the armature is *(a)* simplex lap-wound, *(b)* duplex lap-wound, *(c)* simplex wave-wound?

SOLUTION

(a) Simplex lap-wound:

$$a = mP = (1)(8) = 8 \text{ paths}$$

Therefore, the current per path is

$$I = \frac{I_A}{a} = \frac{120\text{ A}}{8} = 15\text{ A}$$

(b) Duplex lap-wound:

$$a = mP = (2)(8) = 16 \text{ paths}$$

Therefore, the current per path is

$$I = \frac{I_A}{a} = \frac{120\text{ A}}{16} = 7.5\text{ A}$$

(c) Simplex wave-wound:

$$a = 2m = (2)(1) = 2 \text{ paths}$$

Therefore, the current per path is

$$I = \frac{I_A}{a} = \frac{120\text{ A}}{2} = 60\text{ A}$$