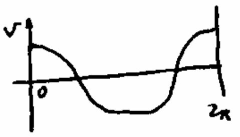
4b. (a) $v = Blu$

$u \int \frac{1}{t}\,dx$



$$V_{AV} = \int_0^t \frac{Blu\,dt}{t} = \int_0^t \frac{BL\,\delta x}{t} = \int_0^t \frac{\delta\phi}{t}$$

ϕ = total flux / pole

Integrating over 1 pole-pitch $\int \delta\phi = \phi$

t = time for 1 pole pitch $= \frac{1}{2n}$; $V_{AV} = \frac{\phi}{1/2n} = 2n\phi$

For a m/c with p pairs of poles $V_{AV} = 2np\phi$. 6

If rotor has Z conductors in parallel and there are c paths then $Z_s = \frac{Z}{c}$ = number of series connected conductors.

For Commutator m/c output is dc = average induced voltage $= V = \frac{2pZ}{c} n\phi$ 2

For slip ring m/c output is ac and if sinusoidal waveform is assumed then form factor is 1.11. Thus rms output is $2pZ_s n\phi \times 1.11$ and taking into account the winding factor k $V = 2.22\,p Z_s n \phi k$ at freq 2

$f = np$; $V = 2.22 Z_s f \phi k$.

[10]

(b) $p = 3$

$\phi = 0.06$ Wb

$Z = 664$

$n = 250$ rpm

$$V = 2p\frac{Z}{c} n\phi = 2 \quad 3 \quad \frac{664}{2} \quad \frac{250}{60} \quad 0.06 = 498\text{ V}$$ 6

for $\phi' = 0.058$ and $V = 250$V

$$n = V \cdot \frac{c}{2pZ\phi} = 250 \quad \frac{2}{2 \quad 3 \quad 664 \quad 0.058} \text{ rev/s}$$

$$= 130 \text{ rpm}$$ 4