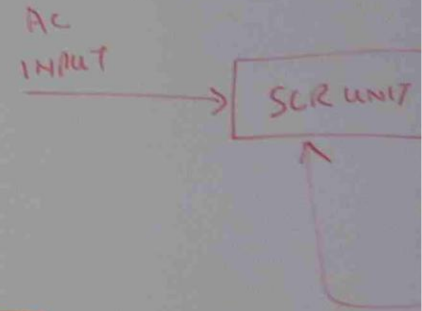
DC MOTOR CONTROL

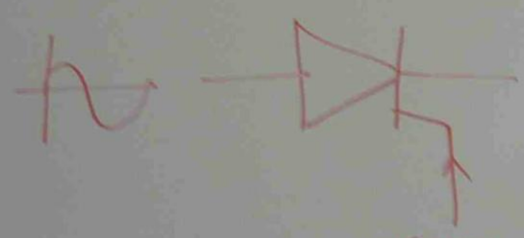
SCR (SILICON CONTROLLED RECTIFIER)

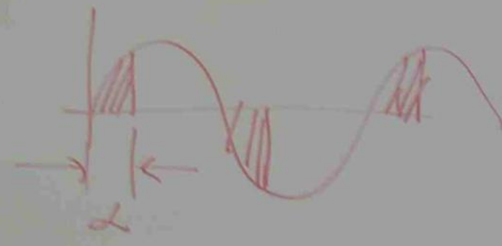
AC MOTOR SPEED CONTROL

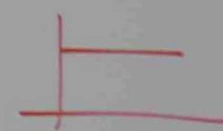
DC MOTOR SPEED CONTROL

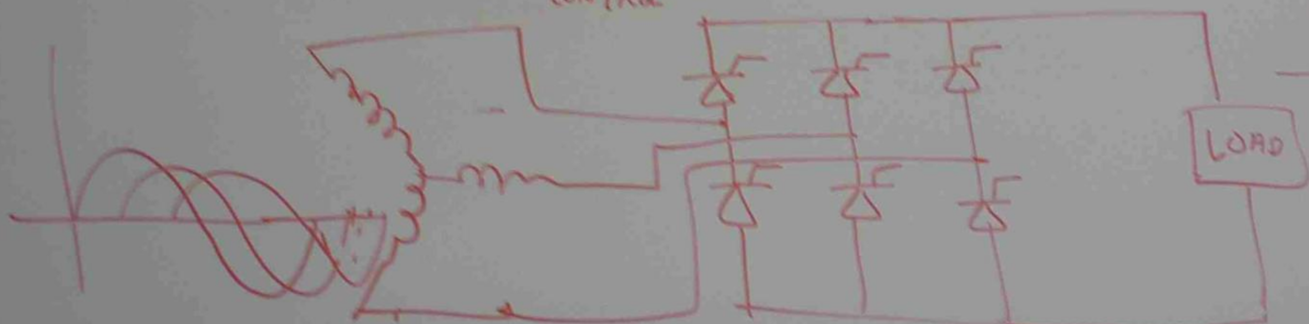
BLOCK DIAGRA

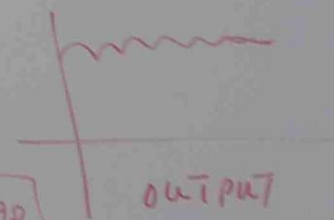










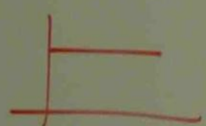


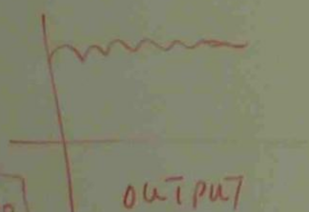
HEA

PRODUCED BY
HIGH FREQUENCY

TIFIER)

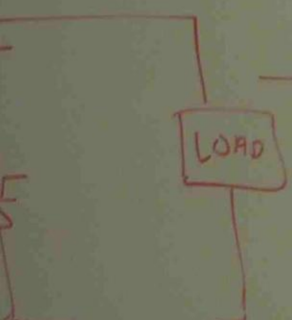
MOTOR
CONTROL



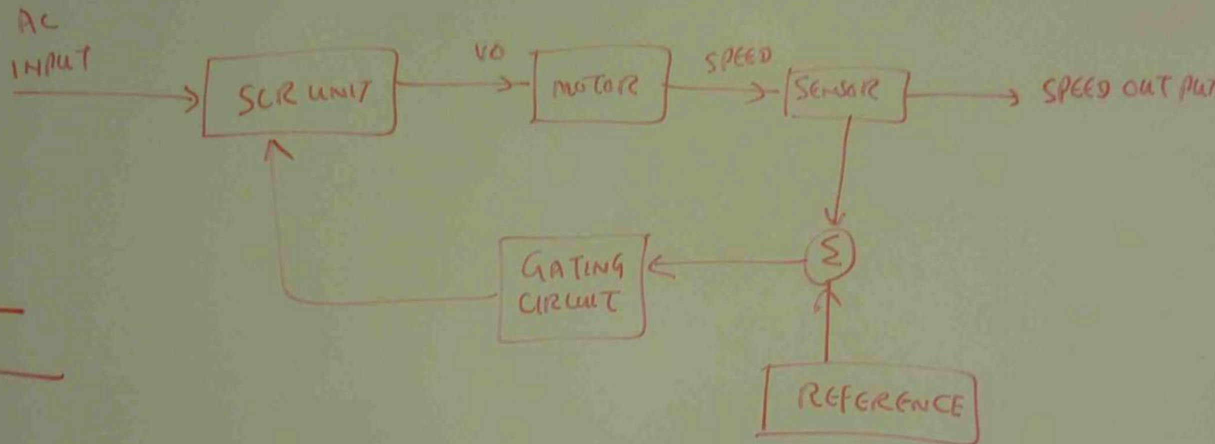


OUTPUT

DC



BLOCK DIAGRAM OF SCR CONTROLLED MOTOR



HEATING EFFECT OF RIPPLES

RIPPLE → HEATING

RIPPLE → HARMONIC → NEED TO BE ELIMINATED BY FILTER

RIPPLE → VIBRATION

RIPPLE → DERATE THE MACHINE

RIPPLE → DERATE THE INSULATION

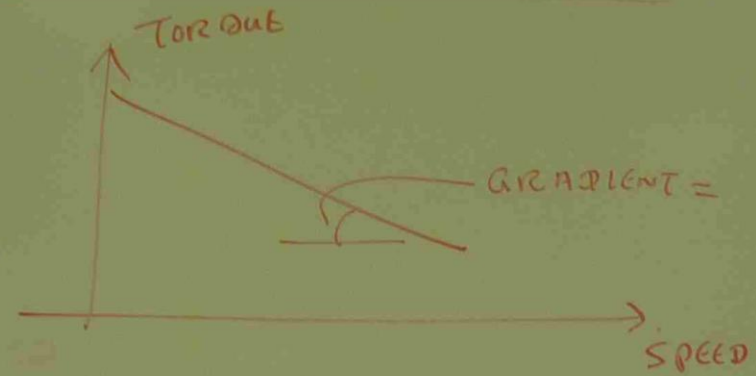
PRODUCED BY HIGH FREQUENCY SWITCHING PWM DRIVES. → RIPPLE

E

T=

T

TORQUE - SPEED RELATIONSHIP



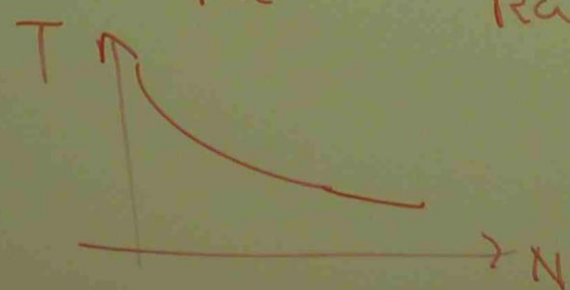
$$T = \frac{K_t \phi V_t}{R_a}$$

$$\text{GRADIENT} = \frac{K_e K_t \phi^2}{R_a}$$

$$K_t = \frac{PZ}{2\pi a}, \quad K_e = \frac{PZ}{60a}$$

$$E_g = K_e \phi N$$

$$T = \frac{K_t \phi V_t}{R_a} - \frac{K_e K_t \phi^2 N}{R_a}$$



T = TORQUE, ϕ = FLUX

I_a = ARMATURE CURRENT

P = NO. OF POLES

Z = ARMATURE CONDUCTORS

a = NO. OF ARMATURE PARALLEL PATHS.

N = SPEED

Pb A 4 POLES WOUND ARMATURE OPERATING IN A FIELD OF FLUX 0.01 WEBERS IN WOUND WITH 360 ARMATURE CONDUCTORS. DETERMINE THE EXPRESSION OF TORQUE AS A FUNCTION OF SPEED IF $V_t = 250V$ AND $R_a = 0.1\Omega$.

$$T = \frac{K_t \phi V_t}{R_a} - \frac{K_e K_t \phi^2 N}{R_a}$$

$$K_t = \frac{PZ}{2\pi a} = \frac{4 \times 360}{2 \times 3.1416 \times 2} = 114.5$$

$a = 2m$ WAVE
$= 2 \times 1 = 2$

$$K_e = \frac{PZ}{60a} = \frac{4 \times 360}{60 \times 2} = 12$$

$$T = \frac{114.5 \times 0.01 \times 250}{0.1} - \frac{12 \times 114.5 \times (0.01)^2 N}{0.1}$$

$$= 2860 - 1.38N$$

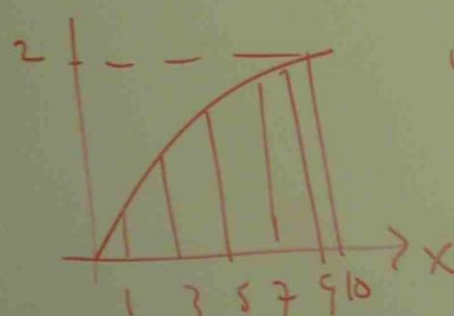
DUTY CYCLE

AS WELL AS SELECTING A MOTOR THAT IS CAPABLE OF DEVELOPING THE SUFFICIENT TORQUE TO DRIVE A LOAD AT THE REQUIRED SPEED, THE MOTOR SO CHOSEN MUST BE ABLE TO PROVIDE THIS TORQUE AND NOT SUFFER ANY UNDUE DAMAGE AS A CONSEQUENCE TO THE HEAT PRODUCED WITHIN THE MACHINE BY THE CURRENTS IN VARIOUS WINDINGS.

THE HEATING EFFECT IS THE FUNCTION OF RM.S

THE RMS VALUE OF THE LOAD MUST BE OBTAINED.

pb



$y = 0.2x$ FIND RMS

$$\text{Rms} = \sqrt{\frac{1}{y}\int_0^y y^2\,dx}$$

$y = 10$

$$\text{Rms} = \sqrt{\frac{1}{10}\int_0^{10} (0.2x)^2\,dx}$$

$$= \sqrt{\frac{1}{10}\int_0^{10} 0.04\,x^2\,dx}$$

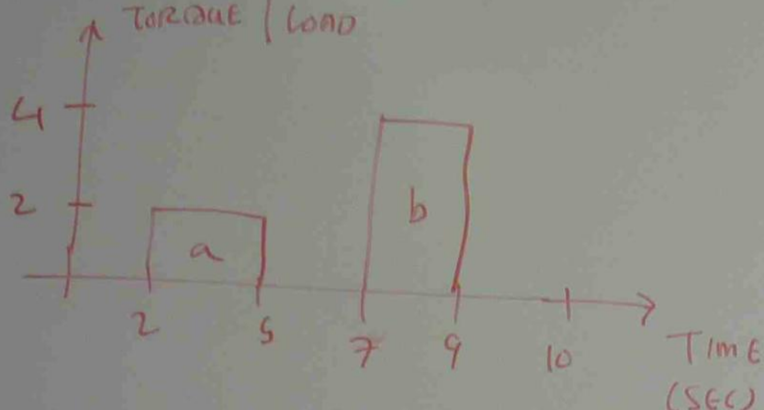
$$= \sqrt{\frac{1}{10} \times 0.04 \int_0^{10} x^2\,dx}$$

$$= \sqrt{\frac{1}{10} \times 0.04 \times \left[\frac{x^3}{3}\right]_0^{10}}$$

$$= \sqrt{\frac{1}{10} \times 0.04 \times \frac{10^3}{3}}$$

$$= 1.153$$

pb. FIND RMS VALUE OF THE GIVEN GRAPH



SECTION	DURATION	VALUE	AREA
a	2 → 5 (5-2=3) 3 sec	2	DURATION × VALUE 3×2=6
b	7 → 9 (9-7=2) 2 sec	4	4×2= 8
		TOTAL	14

$$\text{AVERAGE} = \frac{\text{TOTAL AREA}}{\text{TOTAL DURATION}} = \frac{14}{10} = 1.4$$

$$\text{RMS} = \sqrt{\text{AVERAGE}} = \sqrt{1.4} = 1.183$$