Experiment - 1

Aim. To study the speed of DC Motor

Apparatus DC motor speed control system

Theory.

(1) **Motor Unit :-** Comprises of a small permanent magnet DC motor, rated V = 12 V, rated current at normal run 0.4 A at full load. An overcurrent protection circuit is incorporated if current exceeds.

(2) **Control unit :-** It has speed measurement system, electron tachogenerator, Error detector & forward gain amplifier motor drive circuit, signal source, break control and digital voltmeter for measurement.

(3) **Speed Measurement system :-** Disc attached with motor shaft which interrupt light falling upon a photodiode thus generates 10 pulses for every resolution. These pulses are feed to a signal conditioner. The output of which sends to a frequency counter which indicates the revolutions per minute.

(4) **Tachogenerator :-** A proportional dc voltage is generated a frequency to voltage convertor. This voltage can be applied to motor amplifier by switch nearby tacho out

Observations

Specifications :- KA = error gain

KA = 3, 5, 6, 7, 8, 9
V_R = 0.7 V

Open loop

ON LOAD (with brake)

Error Approx.	V_T	Speed
3	0.25	795
4	0.71	1161
5	0.88	1471
6	1.63	1628
7	2.09	2184
8	2.54	2547
9	3.00	2901

NO LOAD (without brake)

Error approx.	V_T	Speed
3	0.47	426
4	0.83	895
5	1.36	1365
6	1.84	1837
7	2.32	2312
8	2.78	2776
9	3.24	3233

Closed loop

ON LOAD (with brake)

Error approx.	V_T	Speed
3	0.12	218
4	0.28	397
5	0.4	567
6	0.5	706
7	0.58	820
8	0.65	913
9	0.7	994
10	0.75	1198

NO LOAD (without brake)

Error approx.	V_T	Speed
3	0.20	284
4	0.35	492
5	0.46	655
6	0.55	785
7	0.63	893
8	0.7	983
9	0.75	1062
10	0.80	1128

(5) Error detector & forward gain amplifier :- In open loop, the error signals are fed to an amplifier, the gain of which can be altered.

(6) Motor driver amplifier :- It's a unity gain amplifier designed to deliver necessary current to motor.

(7) Digital voltmeter :- A common input of this voltmeter is connected with system ground internally.

(8) Signal source :- A dc reference voltage potentiometer provided for set point V and rectangular wave of , Hz.

(9) Break Control :- Two position switch applied regulated dc voltage to an electromagnet fitted in motor for breaking purpose.

Procedure

Open loop system :→

- Set KA = 0.7V Adjust KA = 9.7V, keep switch towards left hand side thus motor runs in open loop.
- Note the RPM. Apply disturbances by mean of break.
- Switch off break.
- Set KA = 6, Note RPM
- Apply break
- Do it for 2 readings with on load and no load.

Closed loop system :->

- Set $K_A = 4$ and put switch towards V_f at $V_R = 0.7V$ thus to make close loop circuit.
- Repeat steps as before taken for open loop system.

Plot a graph (comparison) taking minimum & maximum gain for open loop & closed loop system with load off / on respectively.

Result

We have plotted the graphs/curves of K_A vs speed in open loop & closed loop systems with $V_R = 0.7V$ and adjusting K_A.

Precautions

- Handle the equipments carefully.
- Switch off the power supply after conducting the experiment.