Speed Control Techniques of DC Drives

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Abstract- *In this paper a comparative analysis between closed loop speed control of chopper fed DC motor & concept of Sensor less direct speed control (SDSC) in Brushless dc motor Drives. In sensor less speed control, does not need proportional plus integral (PI) regulators. The PI regulator is replaced by a comparator in which compare the two phases and generate output.*

Keywords- DC Motor; Closed Loop Operation, PID Controller, Sensor less Speed Drive.

I. INTRODUCTION

he DC motor is used Since 100 Years ago. Earlier Motor is design by using Direct current. DC motors having good speed regulation, light in weight, wide speed ranges & high starting torques. Studies are shown there are more than 90% of industrial drives controller based on PI & PID controller But PID controller fails to respond the desired process specifications.

In 1942's, Ziegler and Nichols have find first method of controlling drives with the parameters of PID controller.
But sensor less Techniques having advantages like cost reduction, high reliability & Compactness.

II. SYSTEM ARCHITECTURE

A. Four Quadrant Chopper

Chopper is a device which converts the fixed dc into variable dc either step up or step down .So that is also called as DC-DC converter. Choppers are used to run
A DC motor in all four quadrants.

B. Figures

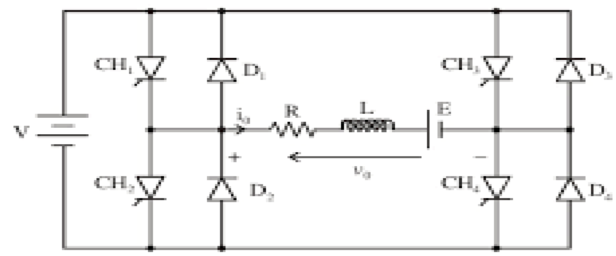


Fig 1. Four Quadrant Chopper Circuit

In forward motoring (quadrant I), Va, Eg, and Ia are for the most part positive. The torque and speed are likewise positive in this quadrant.

During forward braking (quadrant II), the engine keeps running the forward way and the initiated emf Eg keeps on being sure. For the torque to be negative and the course of vitality stream to turn around, the armature current must be negative. The supply voltage Va ought to be kept not as much as Eg

In invert motoring (quadrant III), Va, Eg, and Ia are on the whole negative. The torque and speed are likewise negative in this quadrant. To keep the torque negative and the vitality spill out of the source to the motor, the back emf E_g must satisfy the condition $| V_a | > | E_g |$. The polarity of E_g can be reversed by changing the direction of field current or by reversing the armature terminals.

During reverse braking (quadrant IV), the motor runs in the reverse direction. V_a, and E_g continue to be negative. For the torque to be positive and the energy to flow from the motor to the source, the armature current must be positive. The induced emf Eg must satisfy the condition $| V_a | < | E_g |$.

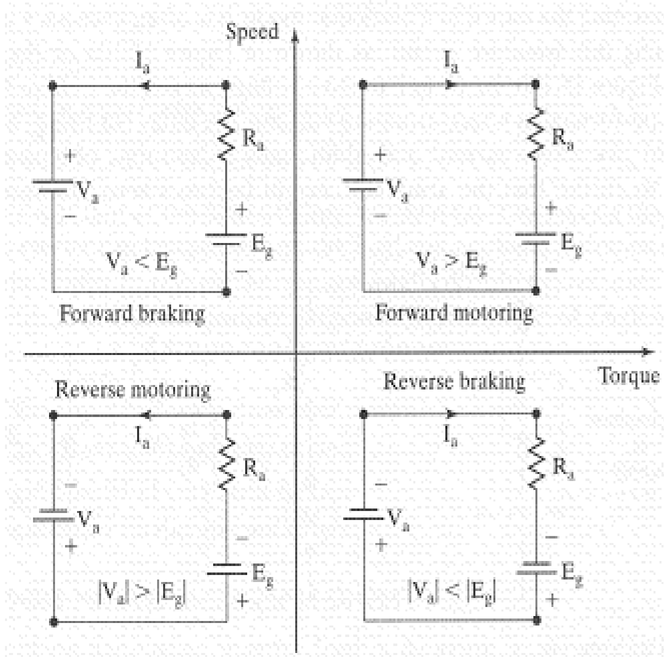
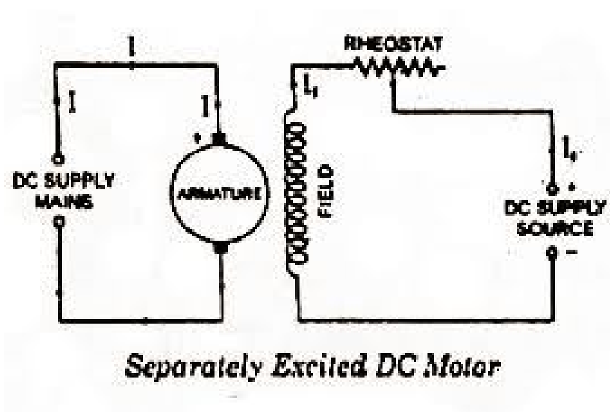


Fig 2. Four Quadrant operation

C. *DC MOTOR SYSTEM*

The schematic outline of DC engine utilized for the examination is given in Independently energized DC engine is utilized as a part of this paper for controlling the speed. For this case, it is accepted that voltage source (V) is the information connected to the engine's armature terminal, while the yield is the rotational speed of the shaft. It is accepted that the gooey erosion demonstrate, that is, the grating torque of the engine is straightforwardly relative to precise speed of the pole.



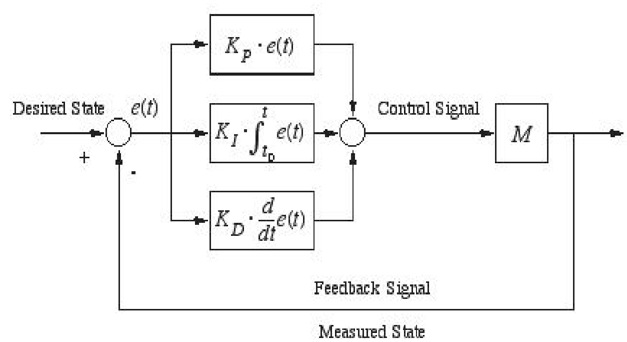
D . CONTROLLERS

Controller is a gadget which screens and changes the working states of a given dynamical framework. The control calculations are normally partitioned into two principle writes: Open-circle what's more, Closed-circle.

The PID controller has been generally utilized as a part of modern applications attributable to its straightforwardness, strength, unwavering quality and simple tuning parameters. PID generally translated as Corresponding, indispensable and Derivative controller has the following properties.

Controller	Response Time	Overshoot	Error
Proportional (P)	small	Large	Small
Integral (I)	Decrease	Increase	Zero
Derivative (D)	Increase	Decrease	Small Change

- P indicates for introduce estimations of the mistake. It implies that if the blunder is huge, the control yield will likewise be vast.
- I gives past estimations of the blunder. For instance, if the introduce yield isn't exceptionally solid, mistake will gather after some time, and the controller will react by applying a more grounded activity.
- D gives the conceivable future estimations of mistake, in light of its present rate of progress.



PID given in controller limits the mistake an incentive by
changing the control variable, for example, Position and Speed and so forth.
The exchange capacity of the PID controller can be spoken to in.

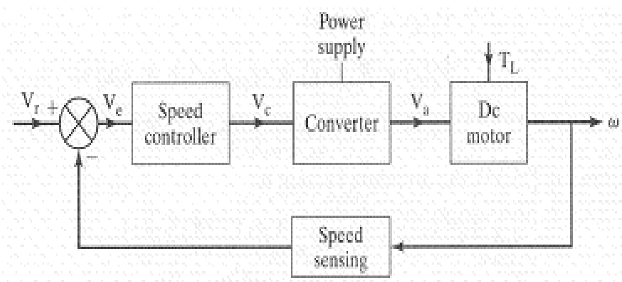
E. Closed Loop Configuration

On the off chance that the speed of the engine diminishes because of the utilization of extra load torque, the speed mistake Ve increments.

The speed controller reactions with an expanded control flag Vc, change the defer edge or obligation cycle of the converter, and increment the armature voltage of the engine.

An expanded armature voltage grows more torque to reestablish the engine speed to the first esteem.

The drive ordinarily goes through a transient period until the point that the created torque is equivalent to the heap torque.



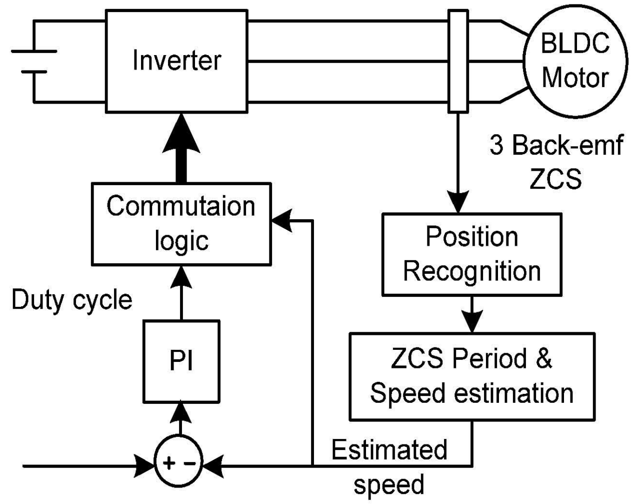
III. SENSOR LESS DIRECT SPEED CONTROL

Sensor less means less parts, i.e. the omission of the position sensors and assistant unraveling hardware [1]. High unwavering quality, cost lessening and minimization are fundamental points of interest of sensor less systems. The main solid approach to use the BLDC machine drives in unforgiving conditions is sensor less procedures. Sensor less systems can be grouped in to four classifications

I) Detection of the zero intersection point (ZCP) of the engine terminal.
2) Back electromagnetic power (back-EMF) combination technique
3) Sensing of the third consonant of the back-EMF
4) Detection of freewheeling diode conduction and related expanded systems.

Among these procedures, ZCP of the engine terminal is broadly utilized as a part of the applications, where accuracy isn't required, similar to dryers, fans, compressor et cetera. Numerous business coordinated circuits (ICs) have been configuration based on this methodology. The traditional sensorless BLDC engine speed control with location of ZCP of the engine terminal is appeared in fig.

Minimization of the criticism instrument is the principle point of this paper. This objective is accomplished by end of PI controller.



IV. PRINCIPLES OF THE PROPOSED SENSORLESS DIRECT SPEED DRIVE

The proposed sensor less system depends on rotational speed control of stator transition linkage. By accepting the abundance of stator motion linkage to be settled, the rotational speed of stator transition linkage influences the electromagnetic torque. An expansion in the rotational speed of stator motion linkage prompts a bring up in the electromagnetic torque. On the other hand, by lessening of the rotational speed of stator transition linkage, the electromagnetic torque diminishes. Along these lines, engine speed can be directed by controlling the stator motion pivot speed.

The guidelines that the proposed sensorless technique takes after are:

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V. CONCLUSION

In this paper a novel idea for sensor less direct speed control of BLDC engine drives is proposed. In the introduced technique, PI controller is excluded and assessed speed is contrasted and the speed reference. Accordingly, the criticism instrument is limited. Speed direction is accomplished by controlling the rotational speed of stator motion linkage.

The proposition is appropriate to both two-stage and three phase conduction modes. Be that as it may, each stage is unexcited for part of time in two-stage conduction mode. Along these lines, stator transition linkage estimation and rotor position acknowledgment is harder than three-stage conduction mode.

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