

Speed Control of D.C. Motor by using half Controlled Converter

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Abstract: This study looks at the use of semi-controlled converters Thyristor Module (BKW75/16) to control the speed of DC motors. It analyzes the principles and performance of semi-control converters in controlling the voltage delivered to the motor, thus controlling the speed of the motor. Various control methods and strategies are studied, such as adjusting the firing angle control to achieve the desired speed profiles and increase efficiency. The experimental validation and simulation results show the efficiency and practicality of using semi-controllable converters to control DC motor speed in a variety of applications, including industrial automation and electric vehicle (EV) propulsion. The results help to advance the knowledge and implementation of effective motor control systems in contemporary engineering practices.

Keyword: DC MOTOR, Half controlled converter or Thyristor module (BKW75/16)

I. INTRODUCTION

Power electronic converters (PECs) play an important role in converting and regulating electrical energy to satisfy the needs of a variety of applications. Direct current (DC) motor technology has revolutionised many industries, allowing for precise rotational speed control and torque control. However, the efficient control of DC motor speed requires advanced control mechanisms that can modulate input voltage and current.

Power converters come in many forms, but there is one type that has gained a lot of attention for its ability to control DC motor speed: half-controlled power converters. While fully controlled power converters offer total control over output voltage and DC motor current, half controlled converters offer partial control over DC motor speed, making them more efficient and cost-effective in some applications [1].

Half-controlled DC motors control DC motor speed by adjusting the output voltage of a semiconductor device, such as a thyristor or a Silicon controlled rectifier (SCR). The firing angle of the semiconductor device modulates the output voltage, which controls the speed of the DC motor [2].

The purpose of this paper is to explain the principles and methodology behind DC motor speed control using Half controlled converters [3]. The purpose of this research is to systematically review relevant literature, theoretical analysis, and empirical studies to explain the operational mechanisms, benefits, and limitations of the use of half controlled converters in the DC motor speed control system. Practical implementations, simulation results and case studies will also be presented to illustrate the effectiveness and use cases of this technology in the real world.

II. CIRCUIT DESCRIPTION

Thyristors (SCRs), diodes, resistors, and a DC motor can be used to create a basic circuit that controls the speed of a DC motor using a half-controlled converter [4]. In other words we can say that speed control of DC motor basically consists in some component or circuit which is mentioned in below with explanation [5].

- Rectifying unit or pulse generating unit
- Half controlled converter or Thyristor module (BKW75/16)
- Step down transformer
- Isolation transformer

Rectifying unit or pulse generating unit

First of all we supply 24volt AC voltage to the rectifier which provides us with an output of 24volt DC voltage. This 24 DC voltage is fed into a Zener diode whose rating is decided as per the requirement of the circuit. So in our case we have used a 15volt Zener diode receiving 15volt DC in a fixed amount. This 15 volt DC voltage is being used as a gate signal passing through a 1:1:1 transformer to prevent losses. We are using a potentiometer between the Zener diode and a 1:1:1 transformer just adjusting the input value of the gate signal or firing angle [6].

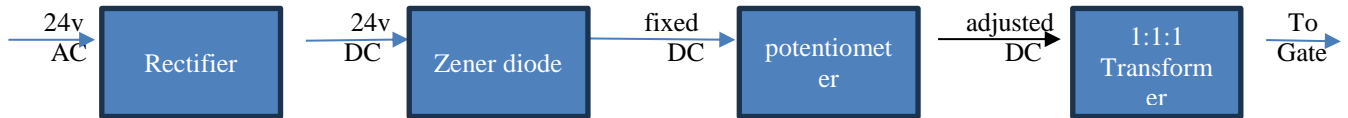


Fig1.1. Rectifying unit or pulse generating unit

Half controlled converter or Thyristor module (BKW75/16)

One kind of power electronic converter used to regulate the flow of electric power is a half-controlled converter, such as the thyristor module BKW75/16 that you described. Below is an explanation of its main parts and how it works [7].

Thyristors: Thyristors are semiconductor switches that only permit one direction of current flow. Only a portion of the thyristors in a half-controlled converter are under control; the remainder conduct automatically in the forward direction when activated.

Diodes: To guarantee that the current flows in the intended direction, the circuit additionally uses diodes in addition to thyristors.

Load: The load is linked to the converter's output. Depending on the use, it could be capacitive, inductive, or resistive.

Applications for half-controlled converters can be found in traction systems, power supply, heating systems, and motor drives, among other industries. They provide benefits such ease of use, dependability, and affordability for moderate-power applications where exact control over output voltage or current is not necessary.

Step down transformer

Here we need 24volt supply for rectifying unit or pulse generating unit for gate signal but we have 220volt supply so we have to use step down (12-0-12 make guru) transformer which is used in our circuit [8].

Isolation transformer:

Here we use isolation transformer supply to the converter or Thyristor module (BKW 75/16) just for protection purpose as we know that .an isolation transformer is a type of transformer that is used to transfer electrical power from a source to a load while providing electrical isolation between the two circuits [9].

III.WORKING OF PROJECT

First of all we are supplying 220volt to step down transformer which provide us the output of 24volt AC. This output is then fed to the rectifying unit or pulse generating unit. The output value coming from rectifying unit is generally adjustable with the help of potentiometer. This adjustable value is given to half controlled converter or thyristor module (BKW75/16) to gate signal and in other side we are supplying 220volt to the thyristor module input terminal through the isolation transformer now we can connect the output terminal of this device to any of the load specially DC motor and hence we can control the load and speed of DC motor by varying its voltage with help of potentiometer.

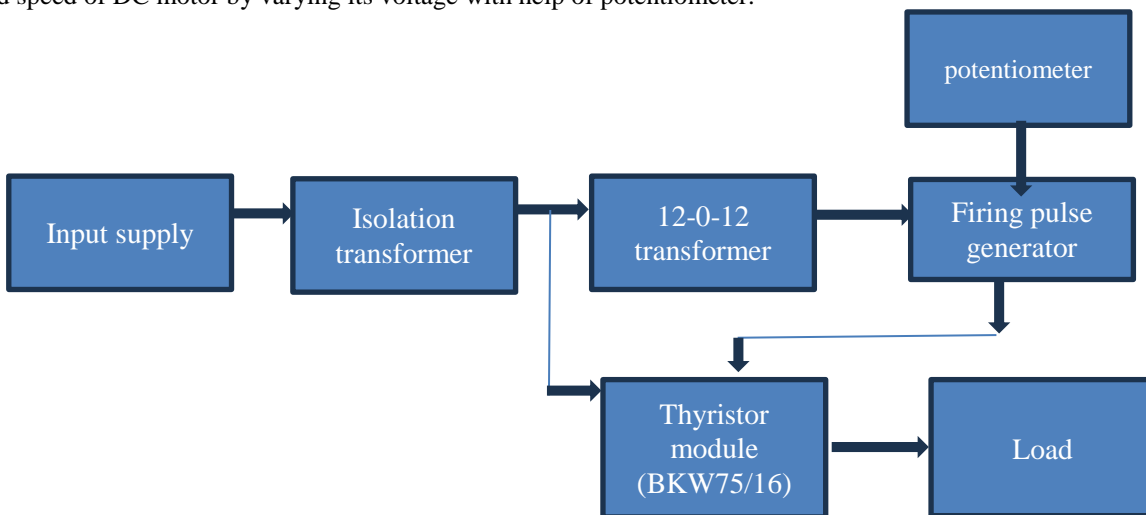


Fig1.2. block diagram of whole project

IV. CONCLUSION

In summary, half-controlled converters offer a viable path for research and practical implementation in a variety of industrial and commercial applications involving the speed control of DC motors. Half-controlled converters provide an economical and effective way to adjust motor speed while preserving acceptable performance characteristics by utilizing thyristors and control circuitry.

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