SNS COLLEGE OF TECHNOLOGY

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COIMBATORE-35

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME: 23EEB210 / Electrical Machines and Drives

II YEAR / IV SEMESTER

Unit V – SOLID STATE SPEED CONTROL OF A.C DRIVES

Topic : Digital control of Stepper Motor

Digital control of Stepper Motor

- A Motor Driver is an essential device that provides the required voltage and current to a stepper motor so that it gets a smooth operation. This is a DC type Motor that turns in steps.
- To design a stepper motor driver, selection of proper power supply, microcontroller, and the motor driver is very important.
- We know that microcontrollers can be used to rotate the motor, but while designing the driver, we have to focus on voltage and current.
- A single motor driver board can handle the currents and voltages for a motor.
- A Stepper motor turns exactly using a controller by synchronizing the pulse signals with the help of a Driver.
- This motor driver takes the pulse signals from a microcontroller and then changes them into the motion of the stepper motor.

Digital control of Stepper Motor

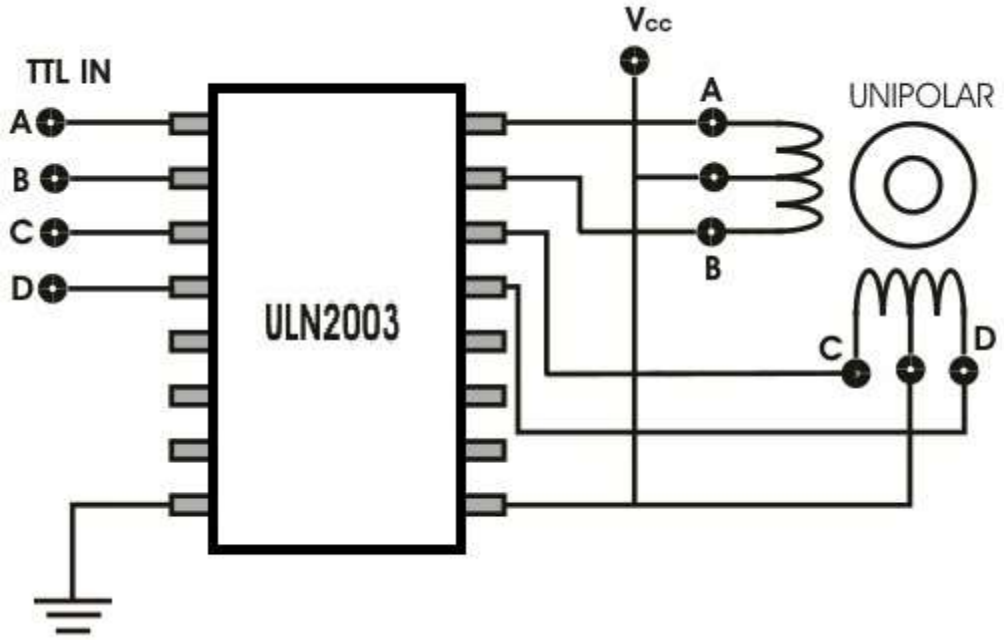
Definition: A motor driver that is designed to drive the motor like a stepper motor to rotate continuously by controlling the exact position without using a feedback system is known as a stepper motor driver. The drivers of this motor mainly provide variable current control as well as several step resolutions. They include fixed translators to allow the motor for controlling by easy step & direction inputs

Digital control of Stepper Motor

These drivers include different kinds of ICs that operate at less than 20 V supply voltage. The low-voltage and low-saturation voltage ICs are best to utilize for a two-phase stepper motor driver which is used in different portable devices like cameras, printers, etc.

These drivers are available in different ratings for voltage as well as current. So the selection of this can be done based on the requirement of the motor which will be utilized. Most of these drivers are available in 0.6”×0.8 size

Digital control of Stepper Motor



Digital control of Stepper Motor

Stepper Motor Driver Working Principle

The working principle of this driver circuit is to control the operating of a stepper motor by sending current using a variety of phases in pulses in the direction of the motor. The designers not frequently used the wave driving technique due to the reasons like it provides small torque & inefficient because simply 1-phase of the motor uses at a time.

The essential components used to drive stepper motor are controllers like a microprocessor/microcontroller, a driver IC and a PSU (power supply unit)., and other components like switches, potentiometers, heat sink, and connecting wires.

Digital control of Stepper Motor

Controller

The first step is to select the microcontroller to design a driver. For the stepper motor, this microcontroller should have a minimum of four output pins. In addition, it includes ADC, timers, serial port based on the application of the driver.

Motor Driver

The motor driver IC's are available at low cost and they are easy to execute in terms of design to progress the whole circuit design time. The selection of the drivers can be done based on the motor ratings like voltages and current. The most popular motor driver like ULN2003 is used in non-H-Bridge based applications. It is suitable for driving the stepper motor. This driver includes a Darlington pair that can handle the max current up to 500mA and the max voltage up to 50VDC. The stepper motor driver circuit is shown below.

Digital control of Stepper Motor

Digital control of Stepper Motor

Power Supply

The operating voltage range of the stepper motor ranges from 5volts to 12volts. The current supply drawn from this will be in the range of 100 mA to 400 mA. The design of the power supply can be done based on the motor specifications. The power supply should be regulated to avoid the fluctuations within torque and speed.

Stepper Motor Driver Types

Drivers are mainly working in two modes like the pulse input mode as well as integrated controller mode. Based on the required operating system, one can select the desired combination.

Digital control of Stepper Motor

Pulse Input Drivers

The control of a stepper motor can be done with the help of a pulse generator offered through the consumer. Earlier, the i/p of the pulse generator is Operation data. The customer selects this input on the host programmable controller, and then enters the operation command.

Built-in Controller Type Drivers

This kind of driver allows the stepper motor to be driving through a PC which is directly connected otherwise a programmable controller. Since no separate pulse generator is necessary, then drivers of this motor can save space & simplifies wiring.

Digital control of Stepper Motor

Advantages and Disadvantages

- Battery drive
- Secure design
- Protection of Spark
- Protection of Thermal
- Mounting Space is small
- This motor driver is used to drive Unipolar Stepper Motors.
- By using this, we can evade expensive driver boards.

The disadvantages are

- The design of this driver is not an efficient one.
- It needs a lot of wiring for a tiny application.

Applications

The applications are

- Industrial
- Brush DC/ Stepper motors

KEEP
LEARNING.

Thank u

SEE YOU IN NEXT CLASS