GOVERNMENT POLYTECHNIC, NANDED

MICRO PROJECT

Academic year: 2018-19

TITLE OF THE PROJECT

Stepper Motor

Program: **Information Tech.** **Program code:** **IF 2 I**

Course: EEC **Course code: 22215**

Name of Guide: - F.N.T DESHMUKH

MAHARASHTRA STATE

BOARD OF TECHNICAL EDUCATION

Certificate

This is to certify that Roll No. 361,362,363 of **2nd** Semester of Diploma in **Information Technology** of Institute, GOVERNMENT POLYTECHNIC has completed the **Micro Project satisfactorily** in Subject -EEC (22215) for the academic year 2019- 2020 as prescribed in the curriculum.

Place: Nanded

Date: ………………………

Subject Teacher	**Head of the Department**	**Principal**
F.N.T DESHMUKH	Mr. S.N DHOLE	Dr .G.V. Garje

WEEKLY PROGRESS REPORT

TITLE OF THE MICRO PROJECT:- Stepper Motor.

W EE K	A C T I V I T Y P E R F O R M E D	SIGN OF GUIDE	DATE
1ST	Discussion and finalization of Topic		
2ND	Discussion and finalization of Topic		
3RD	Preparation and submission of Abstract		
4TH	Literature Review		
5TH	Collection of Data		
6TH	Collection of Data		
7TH	Collection of Data		
8TH	Collection of Data		
9TH	Discussion and Outline of Content		
10TH	Formulation of Content		
11TH	Editing and 1st Proof Reading of Content		
12TH	Editing and 2nd Proof Reading of Content		
13TH	Compilation of Report and Presentation		
14TH	Seminar		
15TH	Viva-voce		
16TH	Final submission of Micro project		

Sign of the student **Sign of the faculty**

F.N.T DESHMUKH

ANEEXURE II

Evaluation Sheet for the Micro Project

Academic Year: 2018-19 **Name of the Faculty: F.N.T DESHMUKH**

Course: EEC **Course code: 22215** **Semester: II**

Title of the project: Stepper Motor.

Cos addressed by Micro Project:

A: Formulate grammatically correct sentences.
B: Give presentation by using audio visual aids.
C: Communicate Skillfully.
D: Write reports using correct guidelines.

Major learning outcomes achieved by students by doing the project

(a) Practical outcome:
Use FHP motors

(b) Unit outcomes in Cognitive domain:
Describe the procedure to connect stepper motor for give application with sketches.

(c) Outcomes in Affective domain:
1) Function as team member.
2) Follow Ethics.
3) Make proper use of computer and Internet

Comments/suggestions about team work /leadership/inter-personal communication (if any)

Connect stepper motor for give application.

Roll No	Student Name	Marks out of 4 for performance in group activity (D5 Col.8)	Marks out of 2for performance in oral/ presentation (D5 Col.9)	Total out of 06
1	Santosh P. surywanshi			
2	Sachin S. swami.			
3	Harsh S. Zanwar			

(Signature of Faculty)

F.N.T DESHMUKH

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Group Details

Sr No.	Content	Page No.
1	SANTOSH PUNDLIK SURYAWANSHI	361
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3	HARSH SANTOSH ZANWAR	363

Course: Element of electrical engineering

Name of Guide:- F.N.T DESHMUKH

Introduction

Stepper motor is a specially designed DC motor that can be driven by giving excitation pulses to the phase windings. They cannot be driven by just connecting the positive and negative leads of the power supply.

They are driven by a stepping sequence which is generated by a controller. The motor moves in steps according to this sequence. This post will discuss the basic theory behind the stepper motors.

Printers are a great source for stepper motors. Old dot matrix printers have a big and a small stepper motor. These are the stepper motors that I was able scavenge out of old dot matrix printers from my dad’s office.

Stepper motor

A stepper motor or **step motor** or **stepping motor** is a brushless DC electric motor that divides a full rotation into a number of equal steps. The motor's position can then be commanded to move and hold at one of these steps without any position sensor for feedback (an open-loop controller), as long as the motor is carefully sized to the application in respect to torque and speed.

A stepper motors

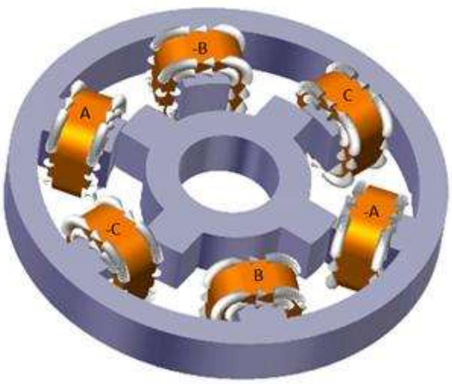
A bipolar hybrid stepper motor

Brushed DC motors rotate continuously when DC voltage is applied to their terminals. The stepper motor is known by its property to convert a train of input pulses (typically square wave pulses) into a precisely defined increment in the shaft position. Each pulse moves the shaft through a fixed angle.

Stepper motors effectively have multiple "toothed" electromagnets arranged around a central gear-shaped piece of iron. The electromagnets are energized by an external driver circuit or a micro controller. To make the motor shaft turn, first, one electromagnet is given power, which magnetically attracts the gear's teeth. When the gear's teeth are aligned to the first electromagnet, they are slightly offset from the next electromagnet. This means that when the next electromagnet is turned on and the first is turned off, the gear rotates slightly to align with the next one. From there the process is repeated. Each of those rotations is called a "step", with an integer number of steps making a full rotation. In that way, the motor can be turned by a precise angle.

The circular arrangement of electromagnets is divided into groups, each group called a phase, and there is an equal number of electromagnets per group. The number of groups is chosen by the designer of the stepper motor. The electromagnets of each group are interleaved with the electromagnets of other groups to form a uniform pattern of arrangement. For example, if the stepper motor has two groups identified as A or B, and ten electromagnets in total, then the grouping pattern would be ABABABABAB.

Electromagnets within the same group are all energized together. Because of this, stepper motors with more phases typically have more wires (or leads) to control the motor.



Type

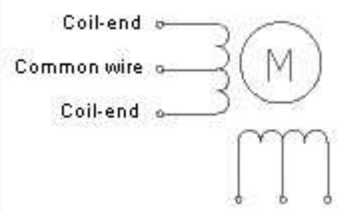
There are three main types of stepper motors:

1. Permanent magnet stepper
2. Variable reluctance stepper
3. Hybrid synchronous stepper

Unipolar motors

A unipolar stepper motor has one winding with center tap per phase. Each section of windings is switched on for each direction of magnetic field. Since in this arrangement a magnetic pole can be reversed without switching the direction of current, the commutation circuit can be made very simple (e.g., a single transistor) for each winding. Typically, given a phase, the center tap of each winding is made common: giving three leads per phase and six leads for a typical two-phase motor. Often, these two-phase commons are internally joined, so the motor has only five leads.

A micro controller or stepper motor controller can be used to activate the drive transistors in the right order, and this ease of operation makes unipolar motors popular with hobbyists; they are probably the cheapest way to get precise angular movements.



Unipolar stepper motor coils

For the experimenter, the windings can be identified by touching the terminal wires together in PM motors. If the terminals of a coil are connected, the shaft becomes harder to turn. One way to distinguish the center tap (common wire) from a coil-end wire is by measuring the resistance. Resistance between common wire and coil-end wire is always half of the resistance between coil-end wires. This is because there is twice the length of coil between the ends and only half from center (common wire) to the end. A quick way to determine if the stepper motor is working is to short circuit every two pairs and try turning the shaft. Whenever a higher than normal resistance is felt, it indicates that the circuit to the winding is closed and that the phase is working.

Bipolar motors

Bipolar motors have a single winding per phase. The current in a winding needs to be reversed in order to reverse a magnetic pole, so the driving circuit must be more complicated, typically with an H-bridge arrangement (however there are several off-the-shelf driver chips available to make this a simple affair). There are two leads per phase, none are common.

A typical driving pattern for a two-coil bipolar stepper motor would be: A+ B+ A- B-. I.e. drive coil A with positive current, then remove current from coil A; then drive coil B with positive current, then remove current from coil B; then drive coil A with negative current (flipping polarity by switching the wires e.g. with an H bridge), then remove current from coil A; then drive coil B with negative current (again flipping polarity same as coil A); the cycle is complete and begins anew.

Static friction effects using an H-bridge have been observed with certain drive topologies.[3]

Dithering the stepper signal at a higher frequency than the motor can respond to will reduce this "static friction" effect.

Because windings are better utilized, they are more powerful than a unipolar motor of the same weight. This is due to the physical space occupied by the windings. A unipolar motor has twice the amount of wire in the same space, but only half used at any point in time, hence is 50% efficient (or approximately 70% of the torque output available). Though a bipolar stepper motor is more complicated to drive, the abundance of driver chips means this is much less difficult to achieve.

An 8-lead stepper is wound like a unipolar stepper, but the leads are not joined to common internally to the motor. This kind of motor can be wired in several configurations:

- Unipolar.
- Bipolar with series windings. This gives higher inductance but lower current per winding.

- Bipolar with parallel windings. This requires higher current but can perform better as the winding inductance is reduced.
- Bipolar with a single winding per phase. This method will run the motor on only half the available windings, which will reduce the available low speed torque but require less current

Stepper motor system

A stepper motor system consists of three basic elements, often combined with some type of user interface (host computer, PLC or dumb terminal):

Indexers

The indexer (or controller) is a microprocessor capable of generating step pulses and direction signals for the driver. In addition, the indexer is typically required to perform many other sophisticated command functions.

Drivers

The driver (or amplifier) converts the indexer command signals into the power necessary to energize the motor windings. There are numerous types of drivers, with different voltage and current ratings and construction technology. Not all drivers are suitable to run all motors, so when designing a motion control system, the driver selection process is critical.

Stepper motors

The stepper motor is an electromagnetic device that converts digital pulses into mechanical shaft rotation. Advantages of step motors are low cost, high reliability, high torque at low speeds and a simple, rugged construction that operates in almost any environment. The main disadvantages in using a stepper motor is the resonance effect often exhibited at low speeds and decreasing torque with increasing speed.

Applications:

1. **Industrial Machines** – Stepper motors are used in automotive gauges and machine tooling automated production equipment's.
2. **Security** – new surveillance products for the security industry.
3. **Medical** – Stepper motors are used inside medical scanners, samplers, and found inside digital dental photography, fluid pumps, respirators and blood analysis machinery.
4. **Consumer Electronics** – Stepper motors in cameras for automatic digital camera focus and zoom functions.

Advantages

1. Low cost for control achieved
2. High torque at startup and low speeds
3. Ruggedness
4. Simplicity of construction
5. Can operate in an open loop control system
6. Low maintenance
7. Less likely to stall or slip
8. Will work in any environment
9. Can be used in robotics in a wide scale.
10. High reliability
11. The rotation angle of the motor is proportional to the input pulse.
12. The motor has full torque at standstill (if the windings are energized)

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CONTENT CONTENT CONCLUSION

REFERENCE:

SOURCES USED