

UNIT – II - STEPPER MOTORS

1. What is stepper motor?

A stepper motor is a digital actuator whose input is in the form of programmed energization of the stator windings and whose output is in the form of discrete angular rotation.

2. Define step angle.

Step angle is defined as the angle through which the motor rotates for each command pulse. It is denoted as β .

$$\beta = (N_s - N_r / N_s \cdot N_r) 360 \quad (\text{or}) \quad 360 / (m N_r)$$

3. Define slewing

The stepper motor operates at very high speed is called slew angle, i.e. (25000 steps per sec).

4. Define resolution

It is defined as the no. of steps needed to complete one revolution of the shaft.
Resolution = no. of steps / revolution

5. Mention some applications of stepper motor

- i. floppy disc drives
- ii. quartz watch
- iii. camera shutter operation
- iv. dot matrix and line printers
- v. small tool application
- vi. robotics

6. What are the advantages and disadvantages of stepper motor?

Adv:

1. it can be driven in open loop without feedback
2. it is mechanically simple
3. it requires little or no maintenance.

Disadv:

1. low efficiency
2. fixed step angle
3. limited power output

7. Define holding torque.

Holding torque is the maximum load torque which the energized stepper motor can withstand without slipping from equilibrium position

8. Define detent torque

Detent torque is the maximum torque which the unenergised stepper motor can withstand without slipping. It is also known as cogging torque.

9. What is meant by full step operation?

Full step operation or single phase on mode is the one in which at a time only one phase winding is energized, due to which one stator winding is energized and causes the rotor to rotate some angle.

10. What is meant by two phase mode of operation?

Two phase on mode is the one in which two phase windings are energized at a time, due to which two stator windings are energized and causes the rotor to rotate through some angle.

11. Define pull in torque.

It is the maximum torque the stepper motor can develop in start - stop mode at a given stepping rate F_s (step/sec) without losing synchronism.

12. Define pull out torque.

It is the maximum torque the stepper motor can develop in slewing mode at a given stepping rate F_s (step/sec) without losing synchronism.

13. What is synchronism in stepper motor?

It is the one to one correspondence between the number of pulses applied to the stepper motor and the number of steps through which the motor has actually moved.

14. Give the types of driver circuits.

- Resistance or L/R drive
- Dual voltage or bilevel drive
- Chopper drive

15. What is multi stack VR motor

Multi stack VR motor is the one in which the stepper motor has three separate magnetically isolated sections or stacks. Here the rotor and stator teeth are equal.

16. What is meant by micro stepping in stepper motor.

The methods of modulating currents through stator windings so as to obtain rotation of stator magnetic field through a small angle to obtain micro stepping action is known as micro stepping.

17. What are the advantages of micro stepping?

- Improvement in resolution.
- Dc motor like performance

- Elimination of mid frequency resonance
- Rapid motion at micro stepping rate.

PART-B

1. Explain the construction and various modes of excitation of VR stepper motor. (16)
2. Explain the construction and various modes of excitation of PM stepper motor. (16)
3. Explain the construction and working principle of Hybrid Stepper motor. (16)
4. State and explain the static and dynamic characteristics of a stepper motor. (16)
5. Explain in detail about different types of power drive circuits for stepper motor. (16)
6. Explain the mechanism of torque production in VR stepper motor. (16)
7. Draw any two drive circuits for stepper motor. (16)

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