



# **SNS COLLEGE OF ENGINEERING**

Kurumbapalayam (Po), Coimbatore – 641 107

**An Autonomous Institution**

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A' Grade  
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

## **DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**

**19EE504 - SPECIAL ELECTRICAL MACHINES**

**UNIT – 3**

**STEPPER MOTOR**





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- Introduction
- Construction
- Working Principle
- Types
- Applications



# Introduction

- A stepper motor is known as step motor or stepping motor.
- It is a brushless DC electric motor that divides a full rotation into number of equal steps.
- A standard motor will have a step angle of 1.8 degrees with 200 steps per revolution.



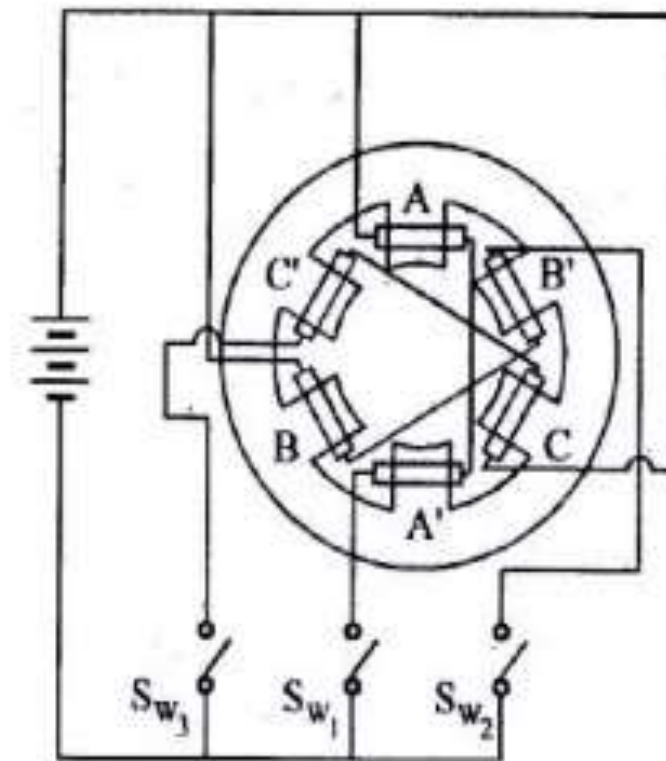
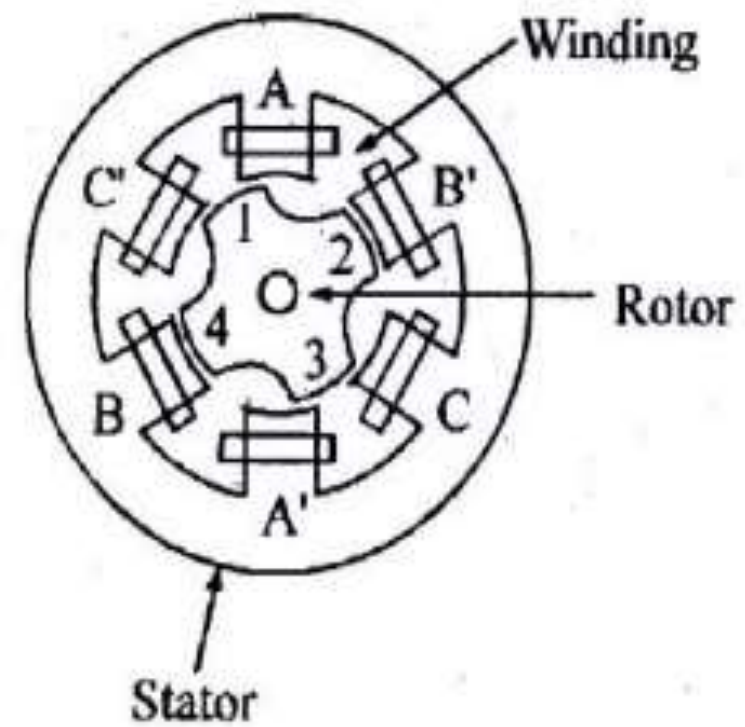


# Construction of Stepper Motor

- Stator:
  - The stator is made of silicon steel stampings
  - It has projected poles , Usually even number of poles.
  - The pole carry concentric windings
- Rotor:
  - Solid silicon steel also used for core of rotor.
  - The rotor has projecting teeth on its outer periphery.

The number of rotor teeth and stator pole should not be equal , this make motor self starting

# Construction of Stepper Motor





# Principle of Stepper Motor

- The operation of this motor works on the principle that unlike poles attract each other and like poles repel each other.
- When stator windings are excited with a DC supply, it produces magnetic flux and establishes the North and South poles.
- The shaft of the stepper motor rotates in discrete step increment when electrical command pulses are applied in proper sequence.
- The motor rotation has direct relationships with applied input pulses.
- The speed of the motor shaft rotation is directly related to frequency of the input pulses.

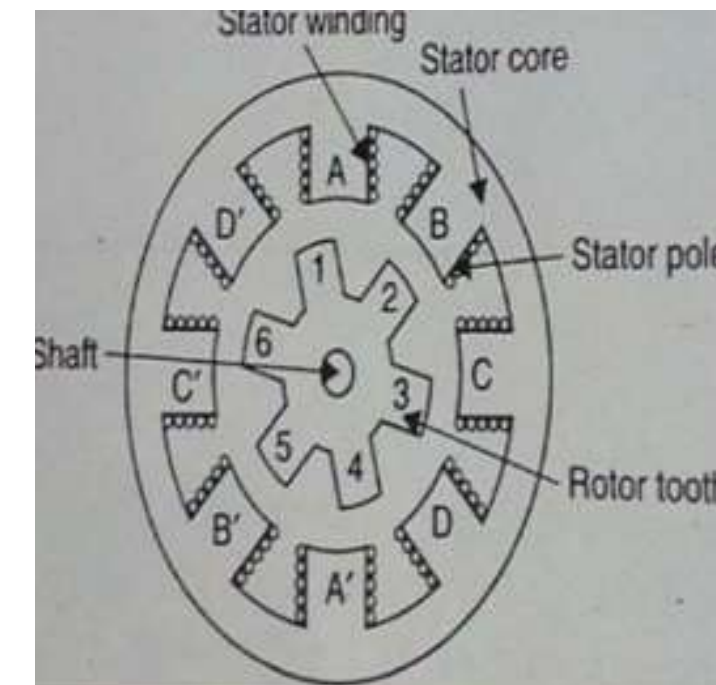


# Modes of Operation of Stepper Motor

- 1 phase ON or full step mode.
- 2-1-2-1 Phase ON (Half Stepping)
- Two phase ON Mode
- Micro Stepping.

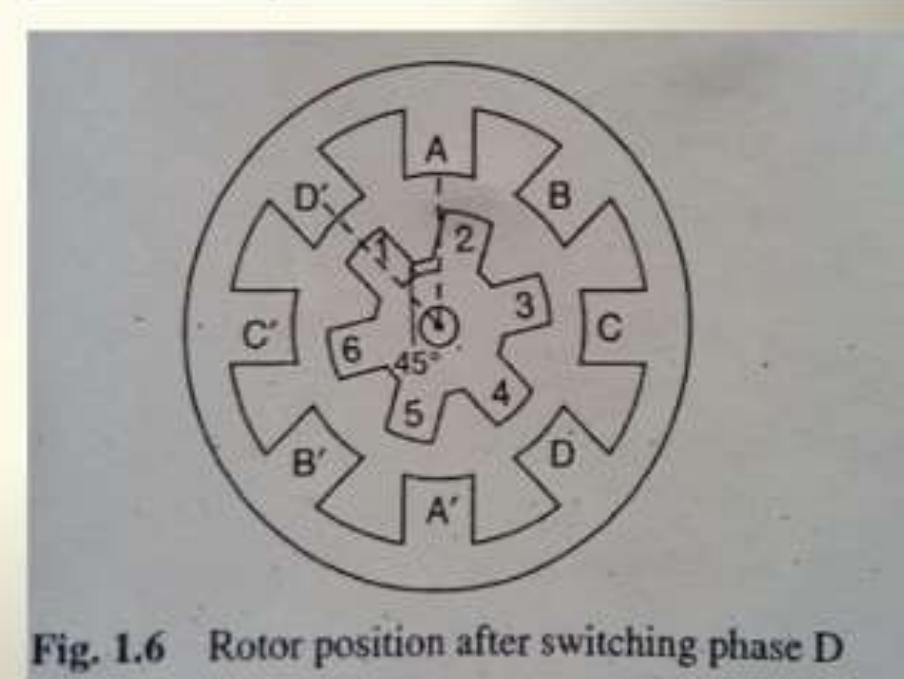
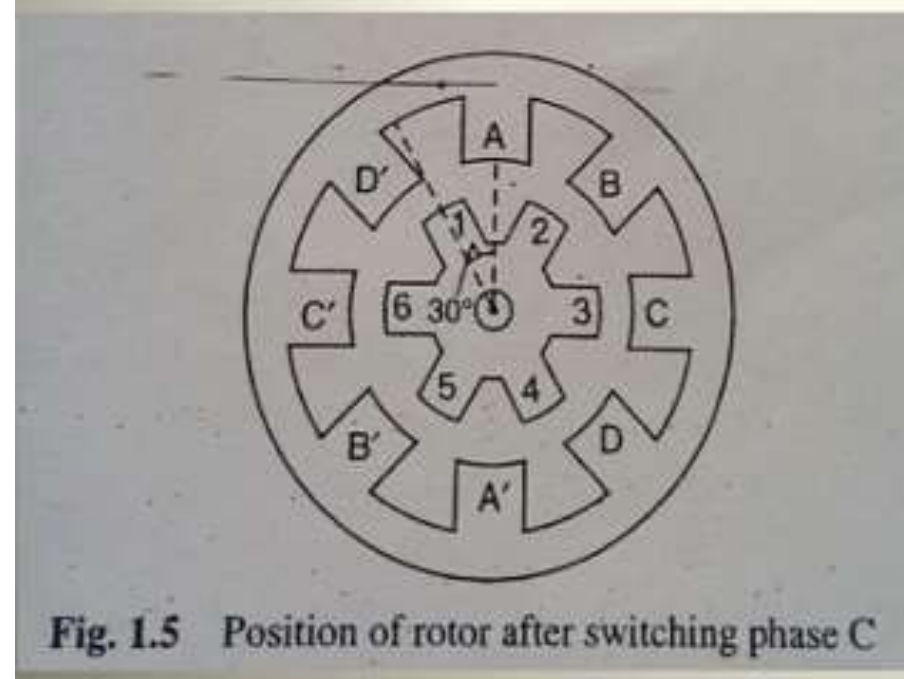
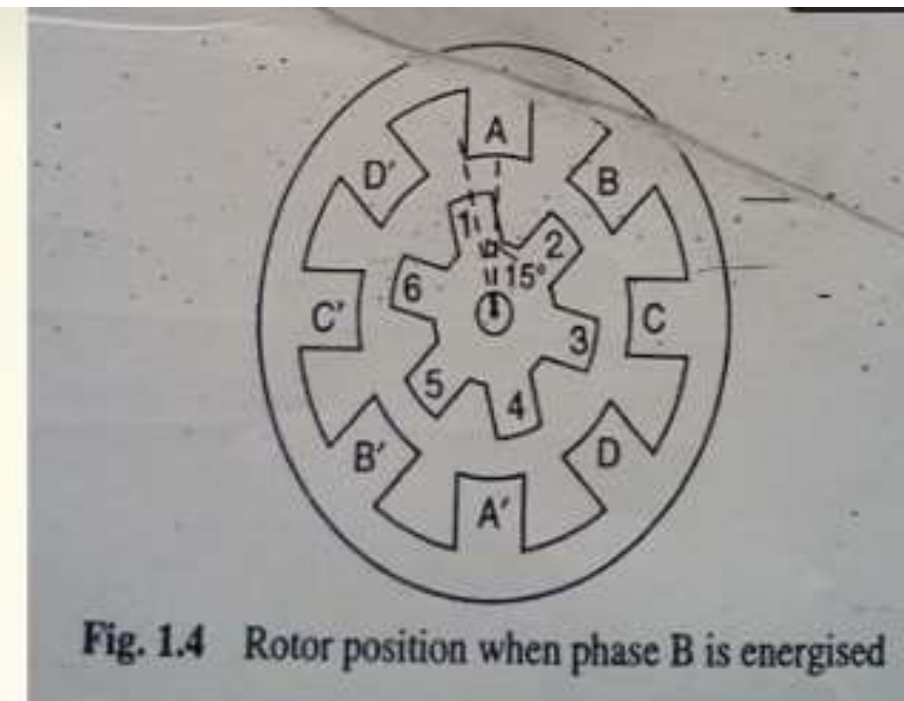
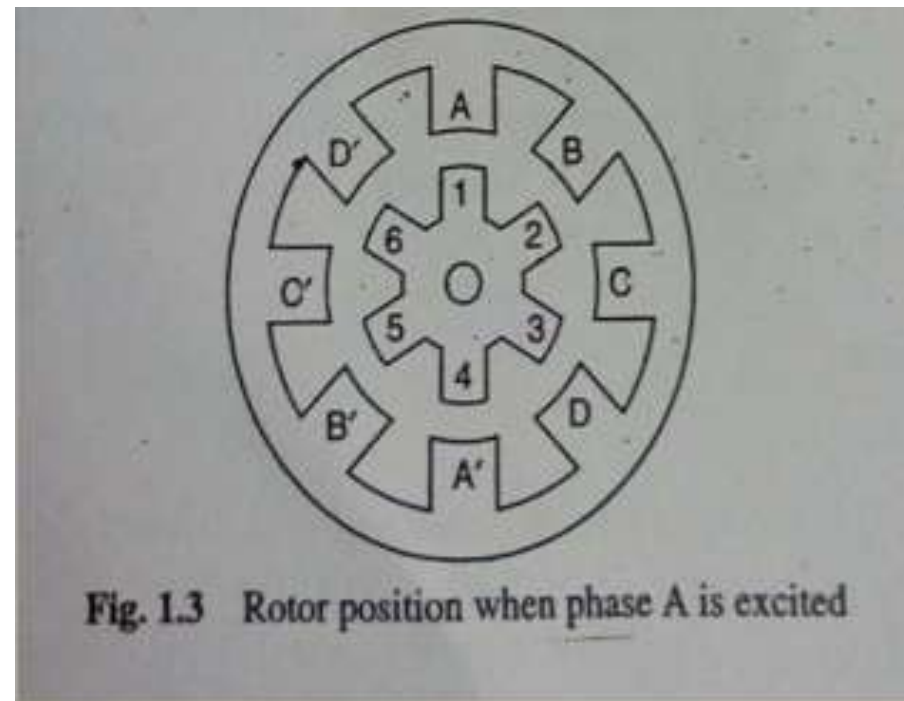
# 1 Phase ON (Full Stepping)

	1- Phase ON (Full Stepping)										
Clock State -->	R	1	2	3	4	5	6	7	8	9	
Phase A	1	1				1				1	
Phase B			1				1				
Phase C				1				1			
Phase D					1				1		
Step (Degrees)	0	0	15	30	45	60	75	90	105	120	
			Steps of 15								





# Rotor Position of Phase Excitation



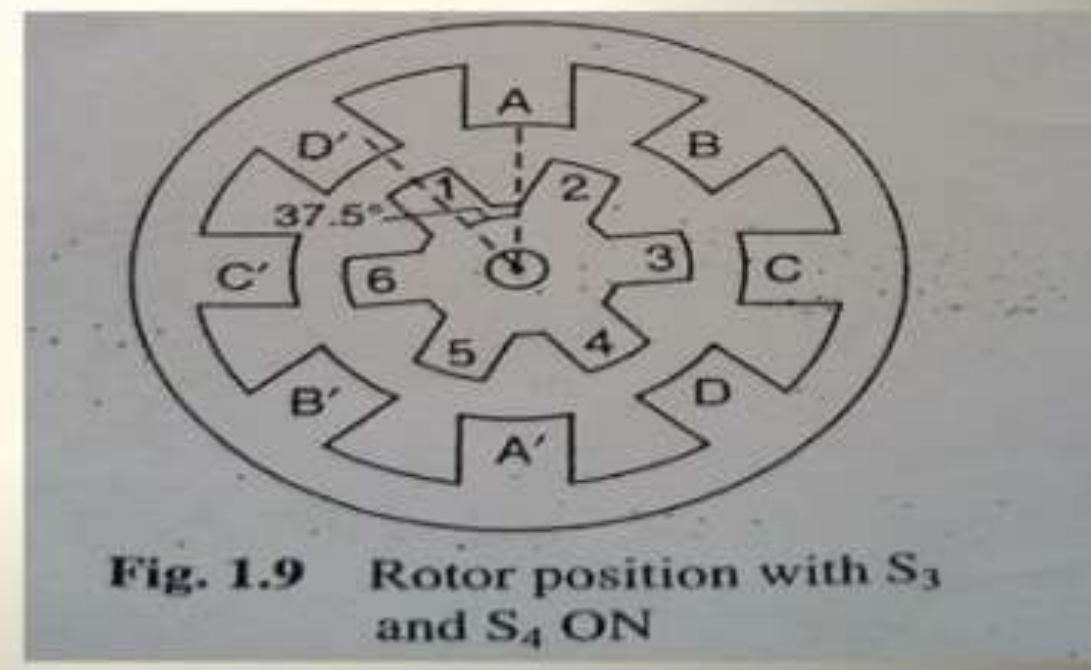
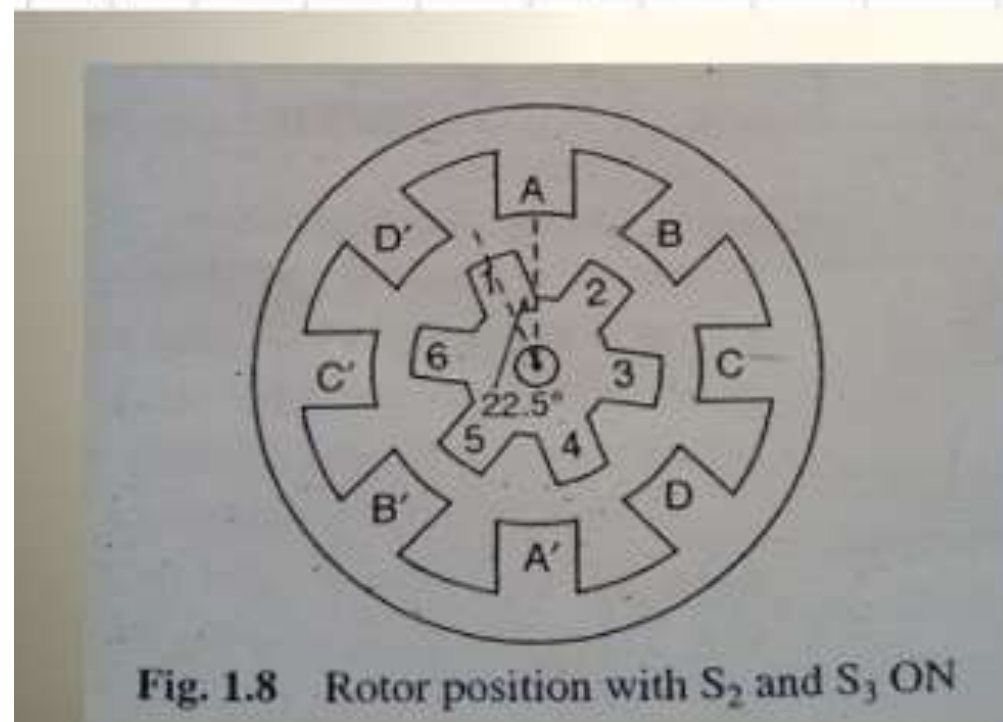
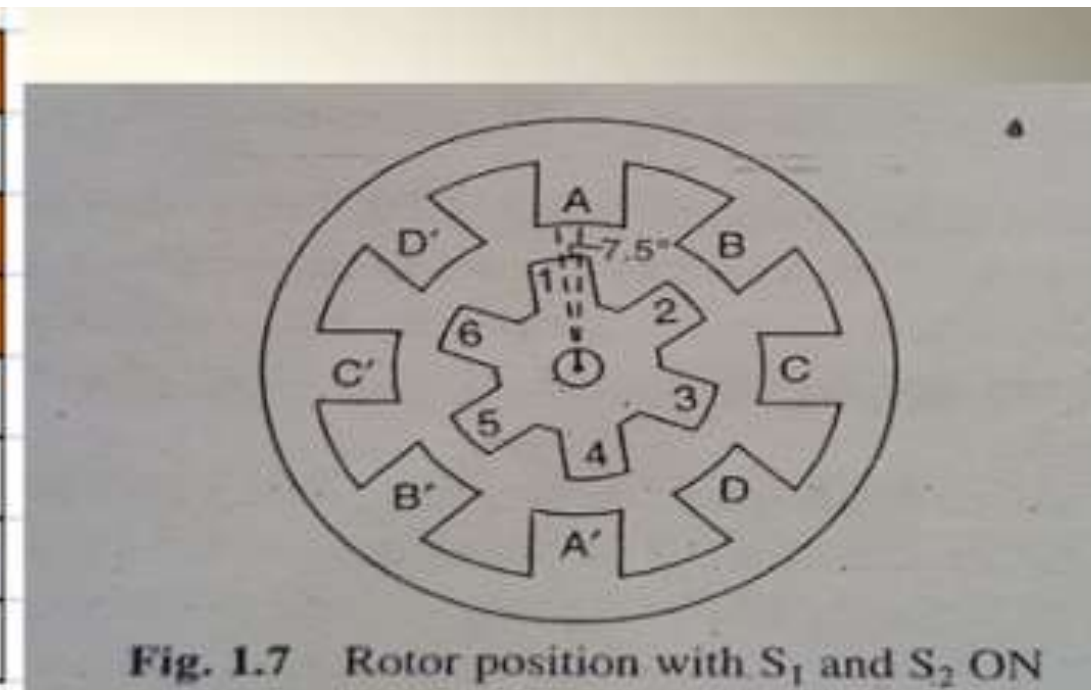


# Half Stepping

2-1-2-1-Phase ON (Half Stepping)									
R	1	2	3	4	5	6	7	8	9
1	1						1	1	1
	1	1	1						1
			1	1	1				
					1	1	1		
0	7.5	15	22.5	30	37.5	45	52.5	60	67.5
Steps of 7.5									

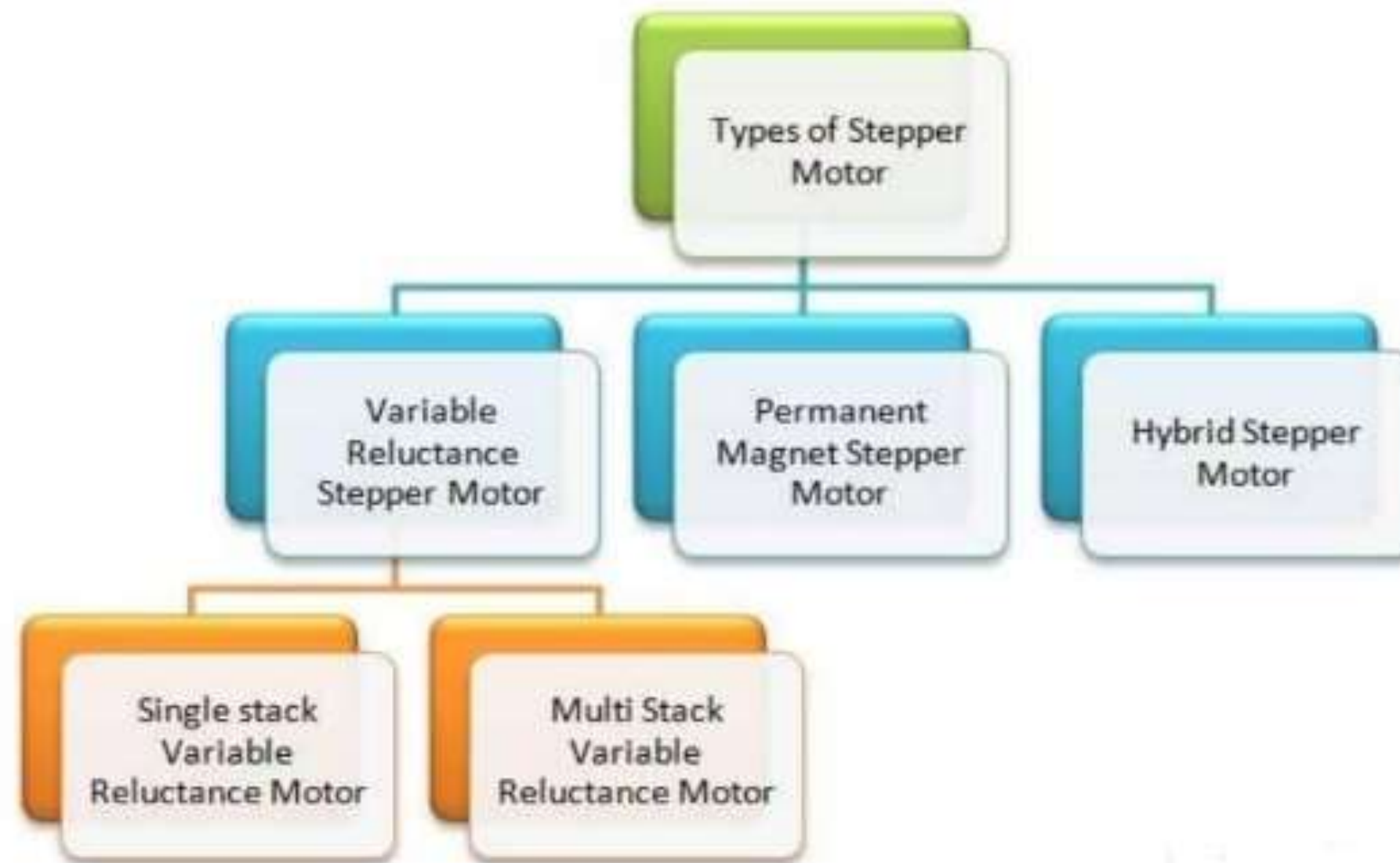
# Two Phase ON Mode

2-Phase ON									
R	1	2	3	4	5	6	7	8	9
	■			■	■			■	■
	■	■			■	■			■
		■	■			■	■		
			■	■			■	■	
0	7.5	22.5	37.5	52.5	67.5	82.5	97.5	112.5	127.5
	Steps of 15								





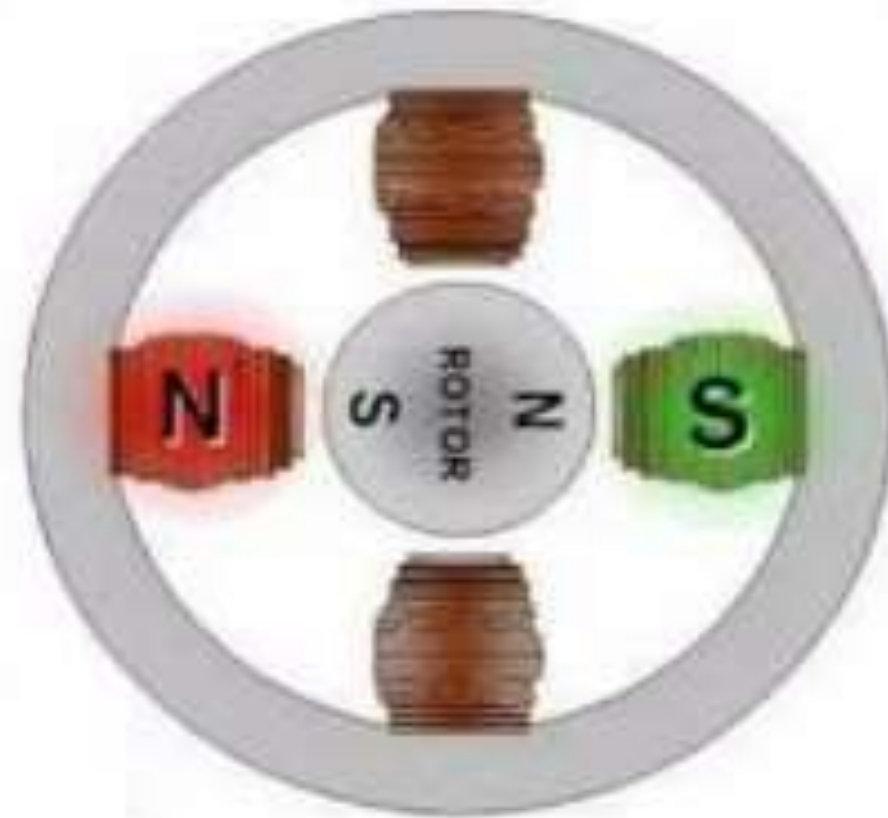
# Classification of Stepper Motor





# Permanent Magnet Motor

- Permanent Magnet motors use a permanent magnet in the rotor and operate on the attraction or repulsion between the rotor PM and the stator magnets.





# System of Stepper Motor

- A stepper motor consists of three basic elements , often combined with some type of interface.
  - Indexers
  - Drivers
  - Stepper Motor.



# Advantages of Stepper Motor

- Low cost.
- High Torque at starting condition.
- Simple in construction.
- Low maintenance
- High Reliability
- Can be used in robotics.



# Applications of Stepper Motor

- Robotics
- Industrial Machines
- Security
- Medical applications



