

# Sensorless Startup Methods

TI Precision Labs – Motor Drivers

Presented and prepared by Eric Chen

# Overview

- Types of Sensorless Startup Methods
- Align
- Slow First Cycle
- Initial Position Detection (IPD)

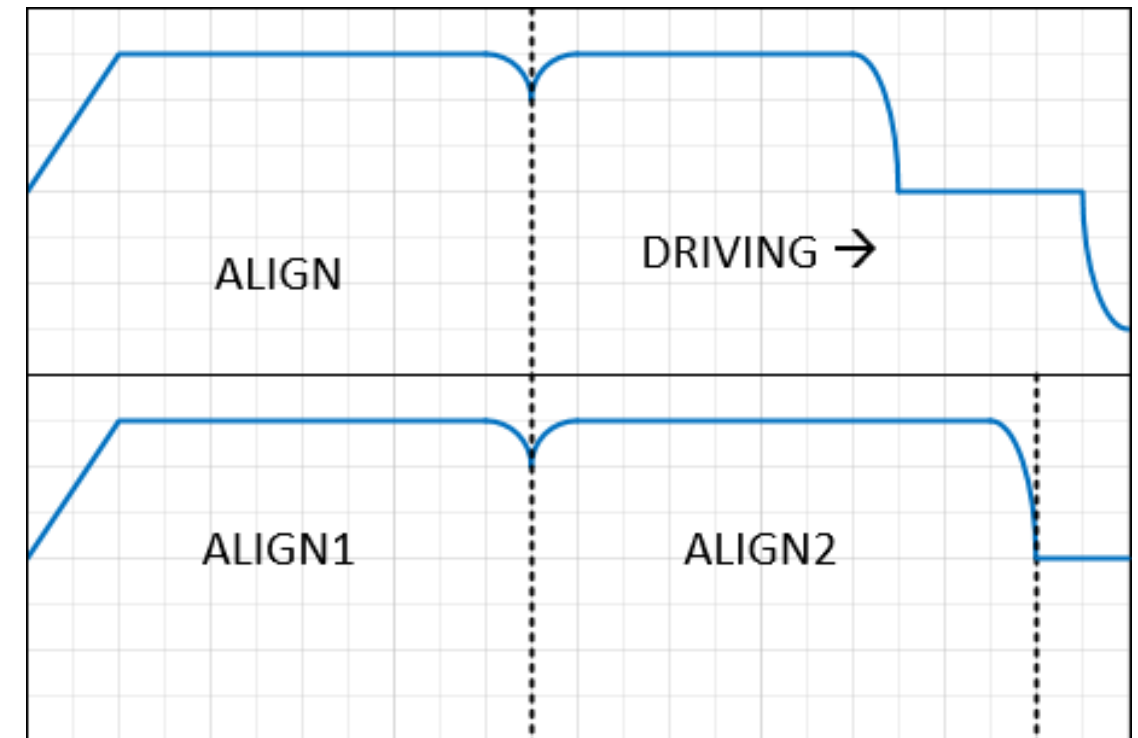
# Types of sensorless motor startup methods

There are 3 techniques for sensorless BLDC motor startup:

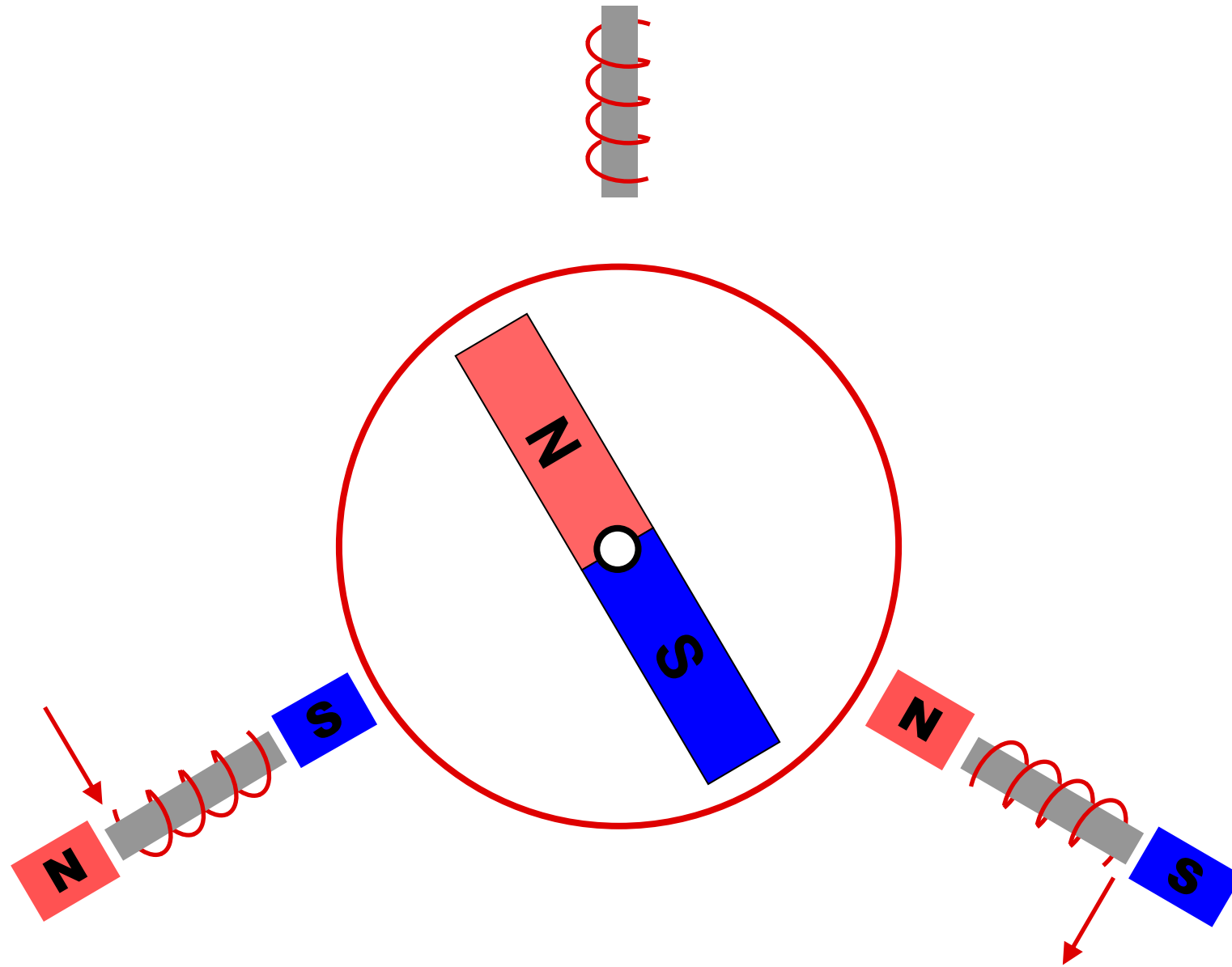
- Align
  - Apply a fixed current for a length of time to force the rotor to a known position
- Slow first cycle
  - Blindly drive with a slow first electrical cycle so the rotor catches up
- Initial position detection (IPD)
  - Uses inductance measurements to determine the position of the rotor

# Align

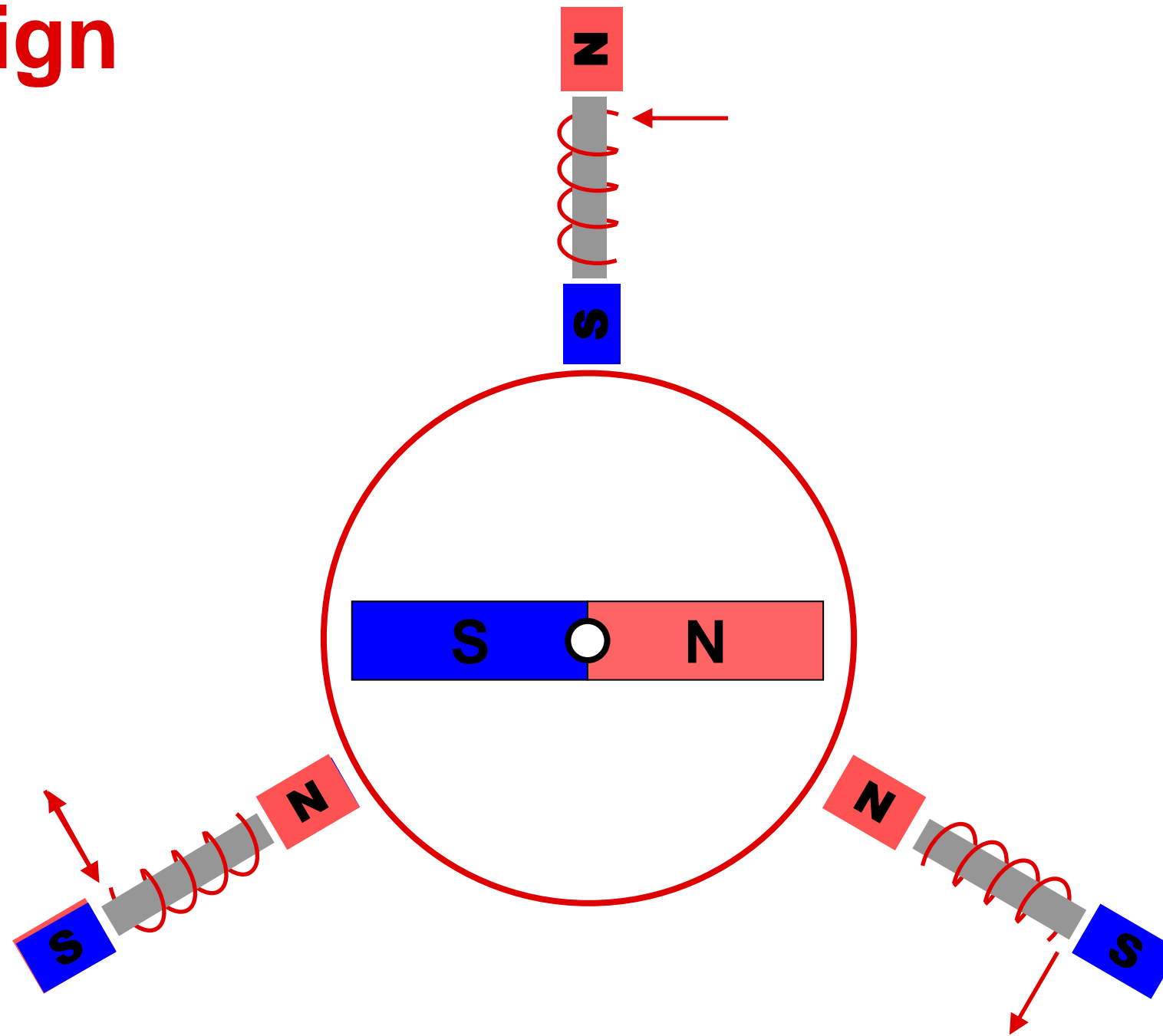
- Force rotor to a known position by applying a vector for a length of time
  - Simple to implement
  - Current and time period are dependent on motor parameters
  - Motor can spin backwards during align
  - Single align may result in unreliable startup
- **Single align** – Apply 1 align vector to force rotor to a known position
  - May be unreliable if rotor happens to be 180° out of phase from applied vector
- **Double align** – Apply 2 consecutive align vectors to force rotor to a known position
  - Takes twice as long as single align



# Align



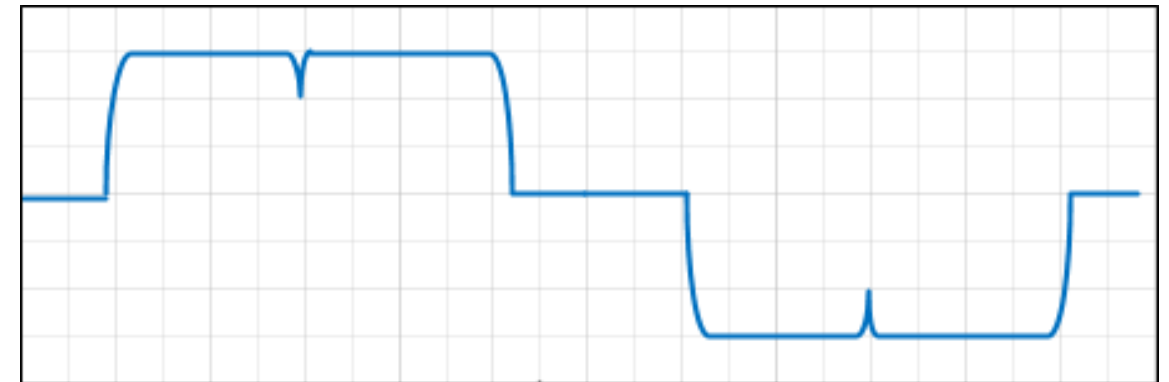
# Double align



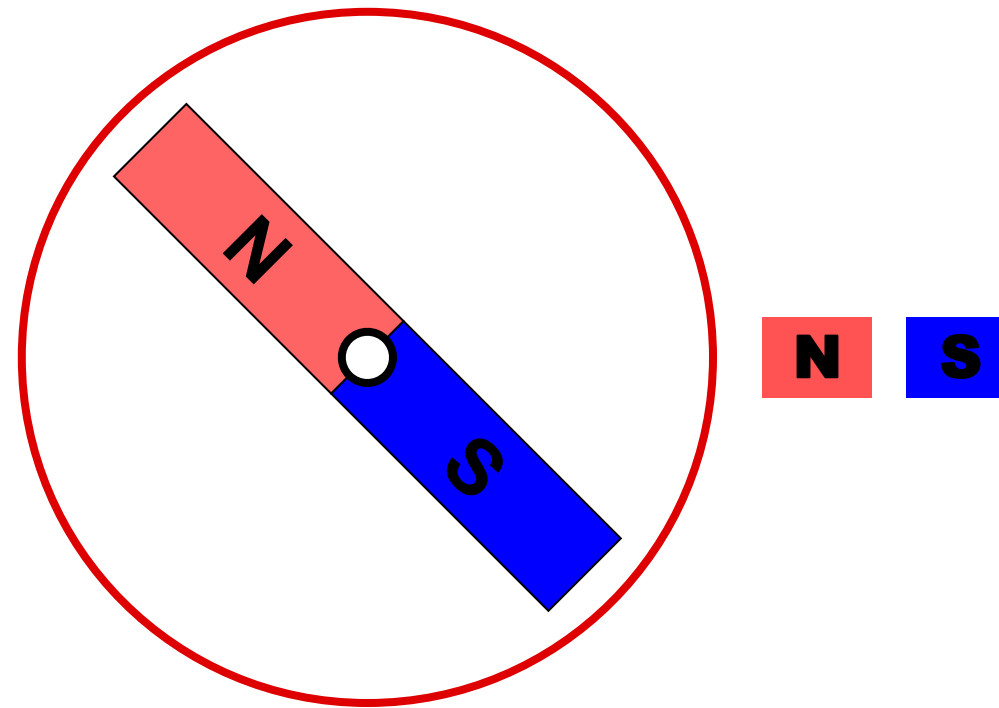


# Slow first cycle

- Blindly drive with the first electrical cycle with a slow cycle such that the rotor catches up, and from the second electrical cycle, acceleration is done in open loop
  - Fast startup
  - Need to have low start-up torque requirement
  - Motor can spin backwards during slow first cycle



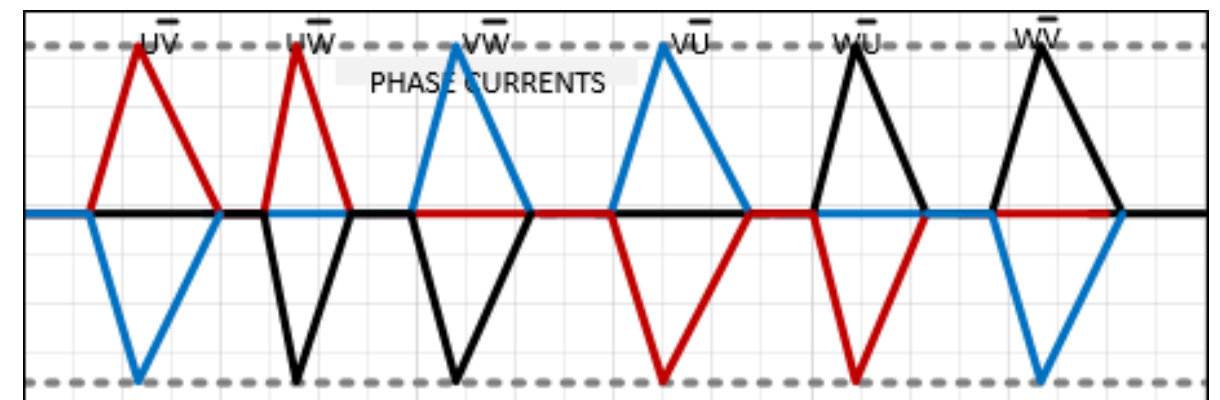
# Slow first cycle



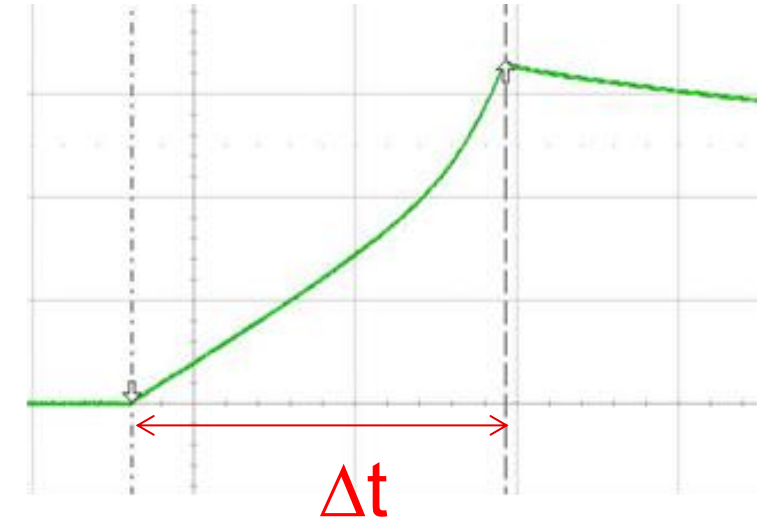
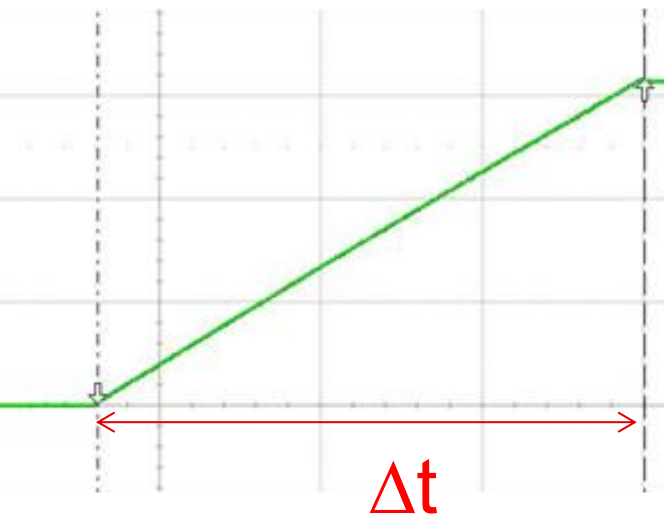
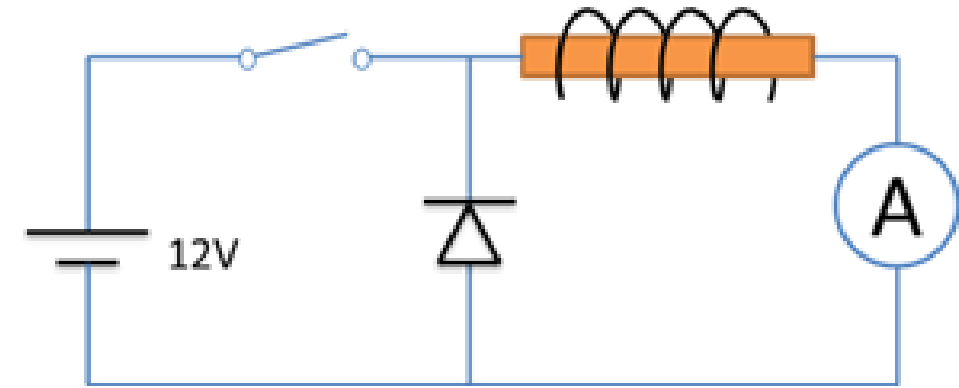
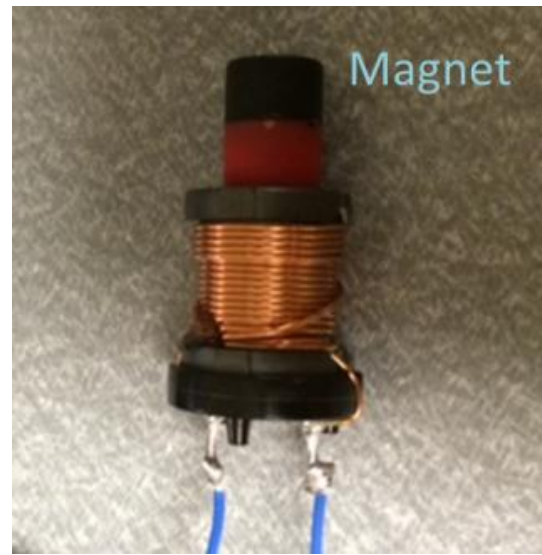
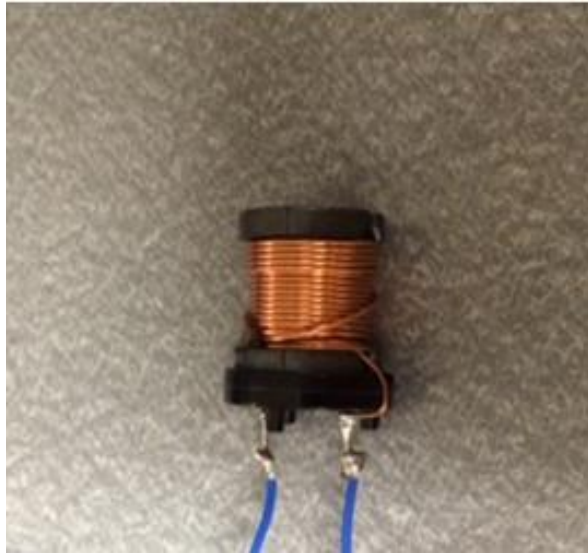


# Initial position detection (IPD)

- Apply 6 short pulse sequences called vectors to find out the rotor position
  - Avoids motor back spin
  - Requires additional comparator(s), timers and decision logic
  - Current dependent on motor parameters

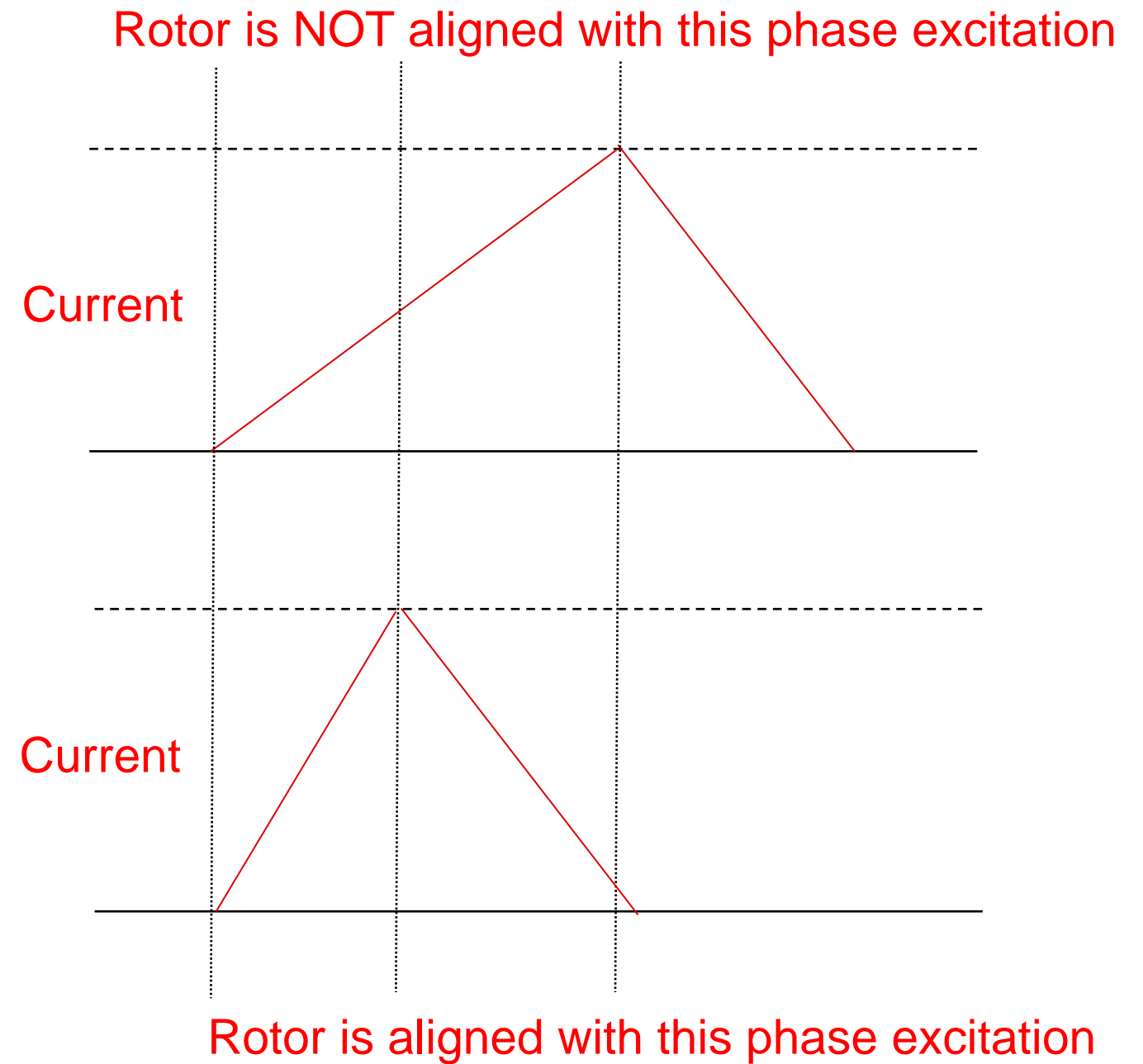
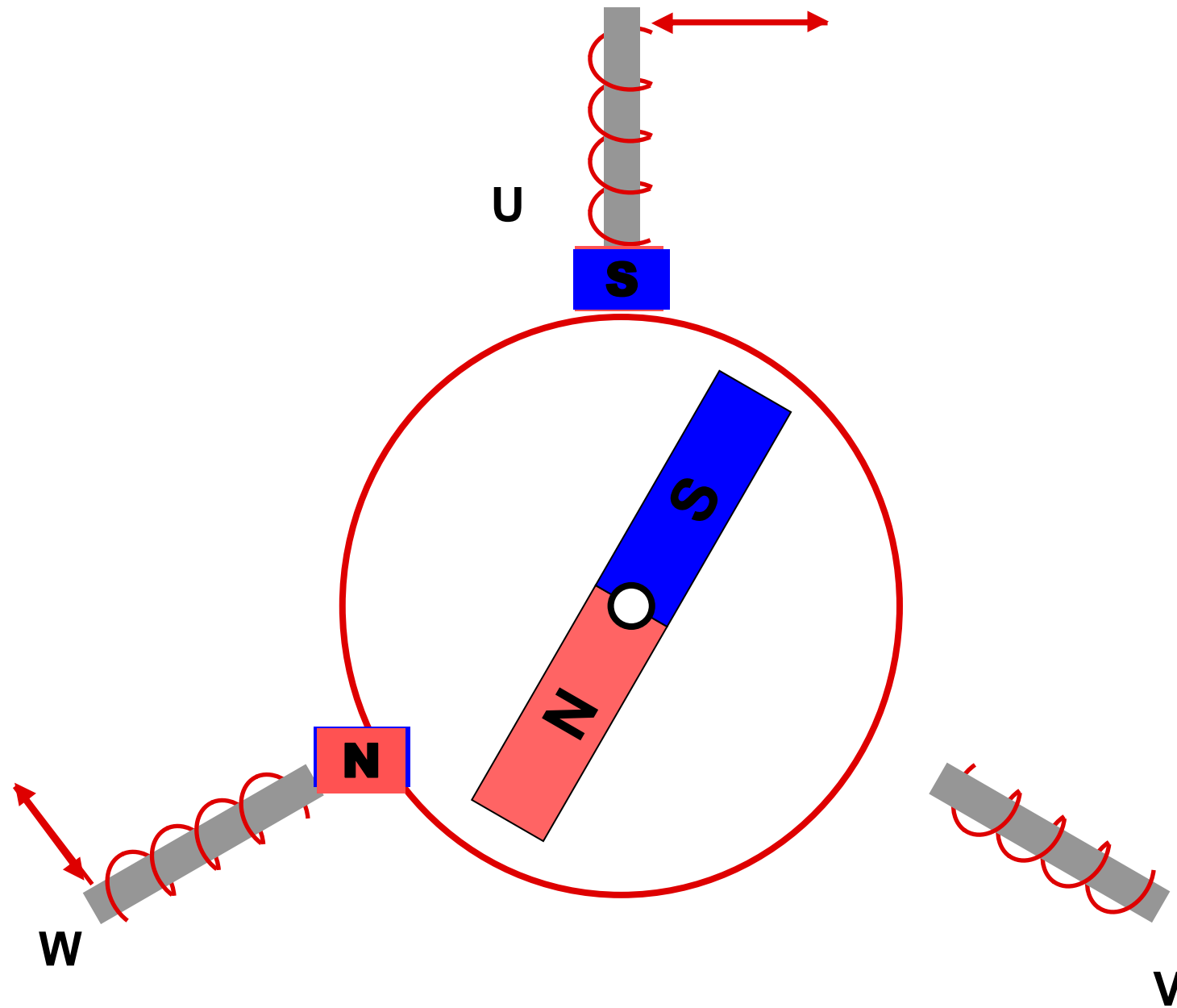


# Initial position detection (IPD)

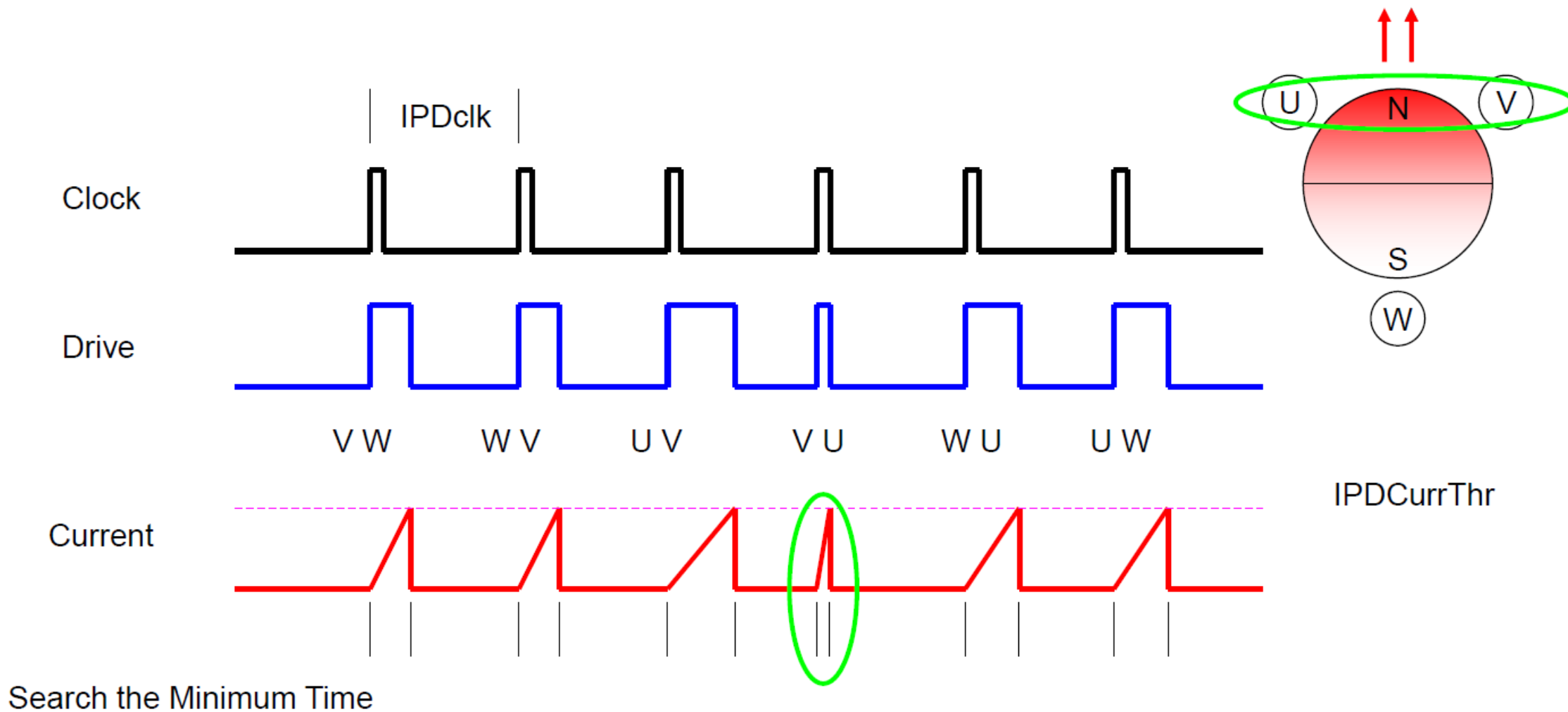


Stronger magnet  
→

# Initial position detection (IPD)



# Initial position detection (IPD)



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