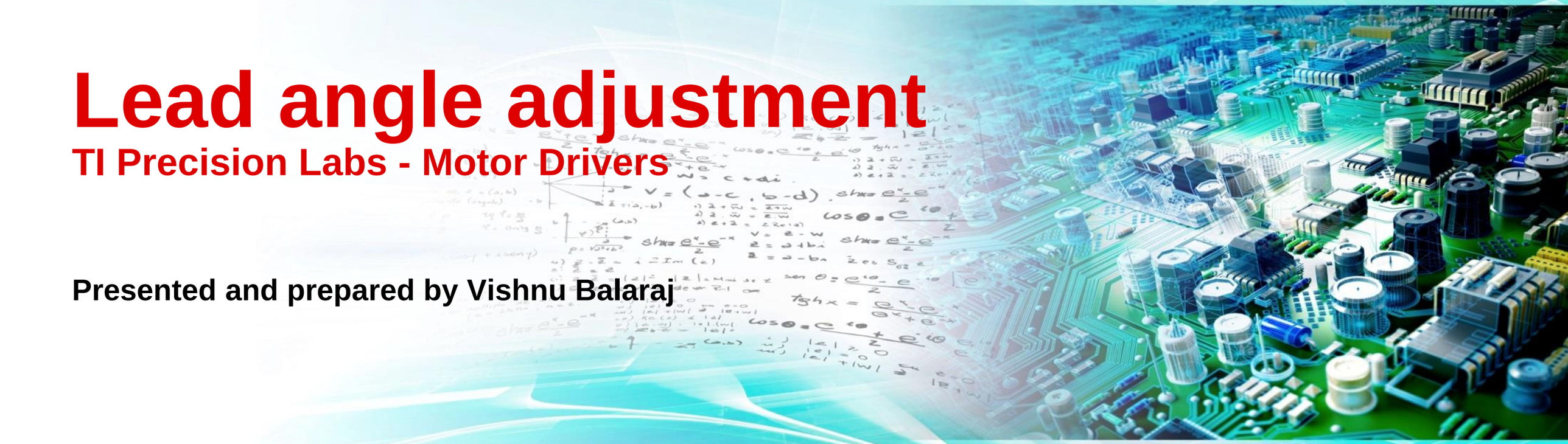
Lead angle adjustment

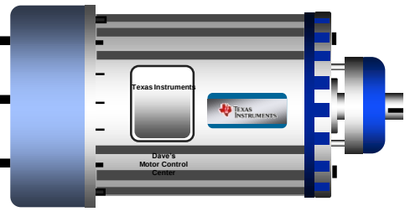
TI Precision Labs - Motor Drivers

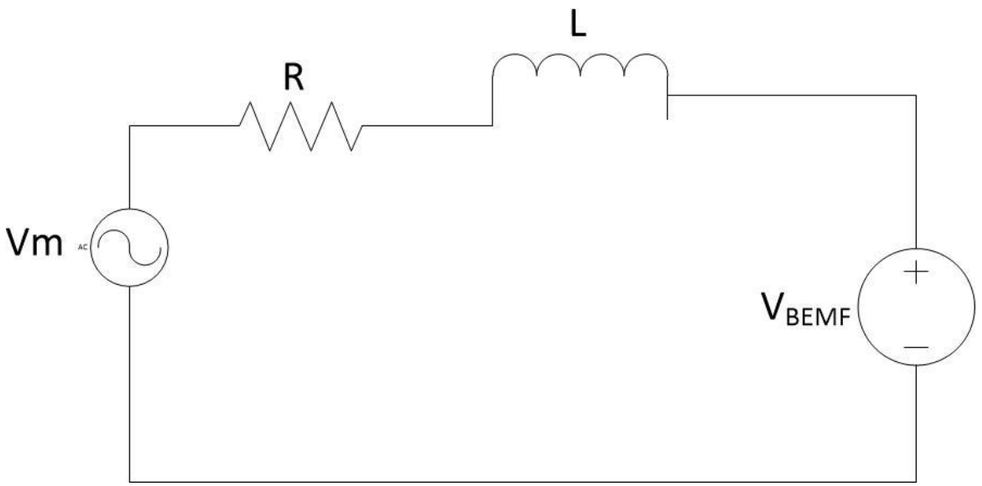


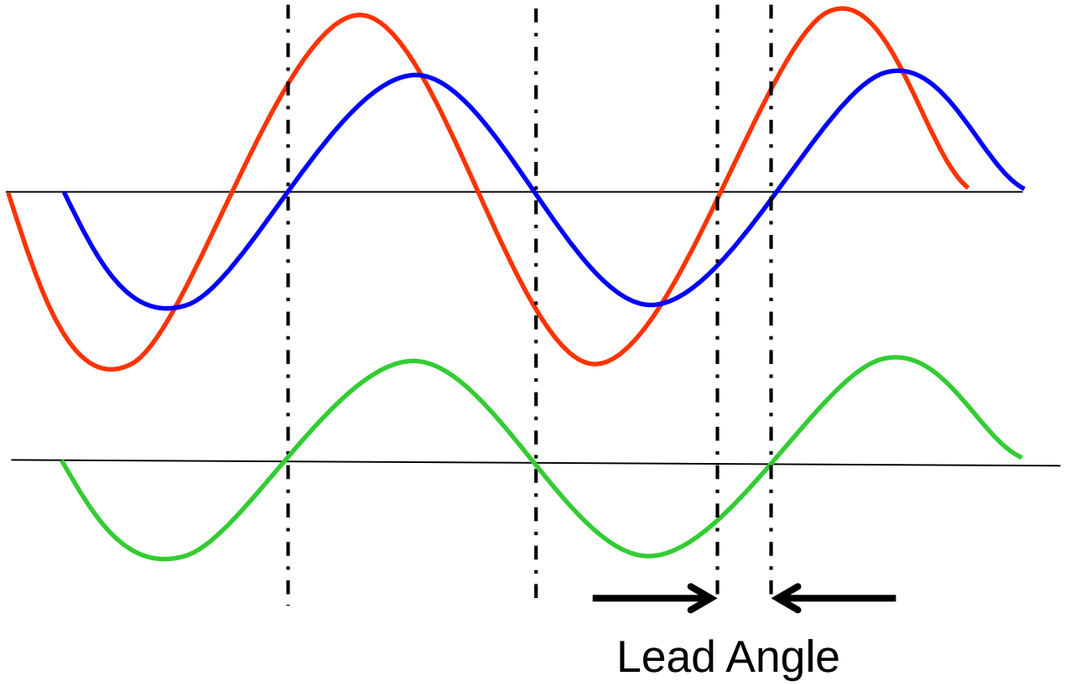
Presented and prepared by Vishnu Balaraj

What is lead angle?

Sinusoidal BLDC Motor Driver





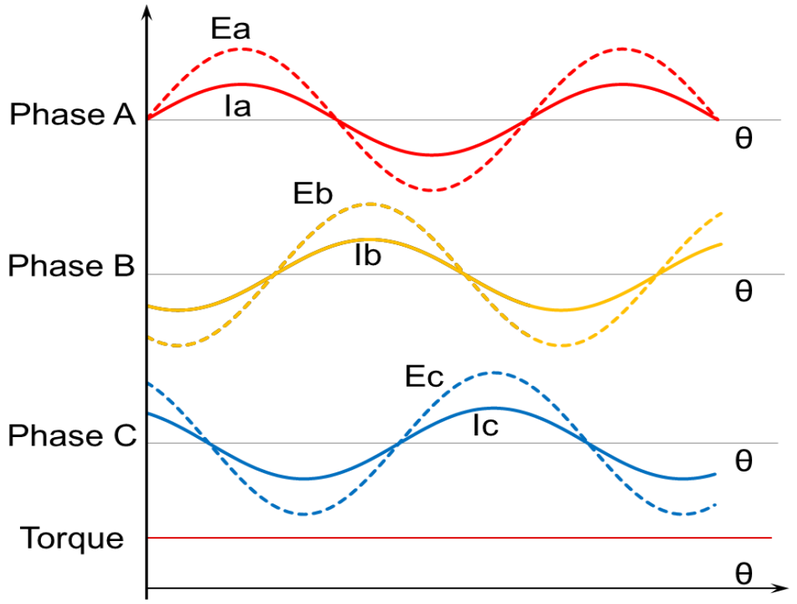


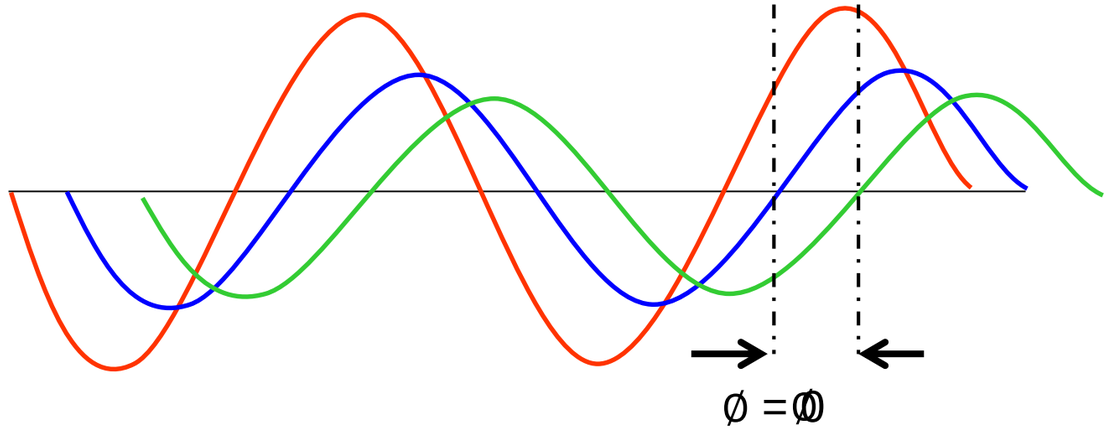
Phase Voltage

Phase Current

Phase BEMF voltage

Why is lead angle important?





Phase Voltage Vm

Phase Current

Phase BEMF voltage

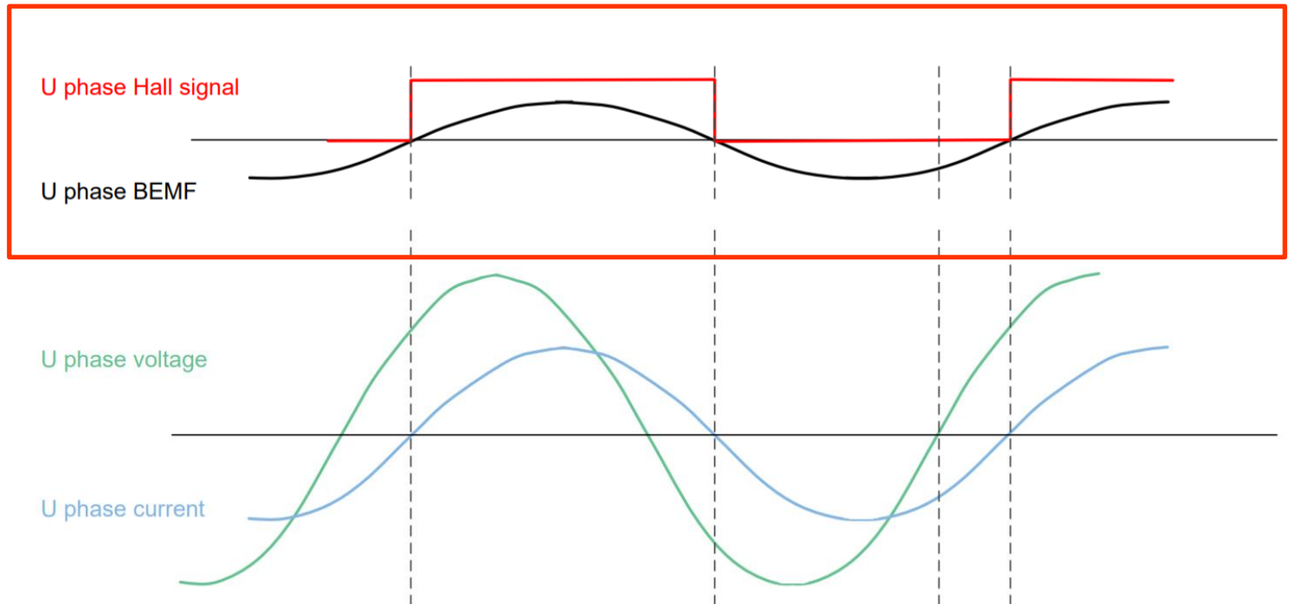
$$Power\ Generated\ in\ the\ motor = (E_a \times I_a) + (E_b \times I_b) + (E_c \times I_c)$$

$$= \sqrt{3} \times E_{ab} \times I_a \times \cos \emptyset$$

(∅ - angle between BEMF voltage and phase current)

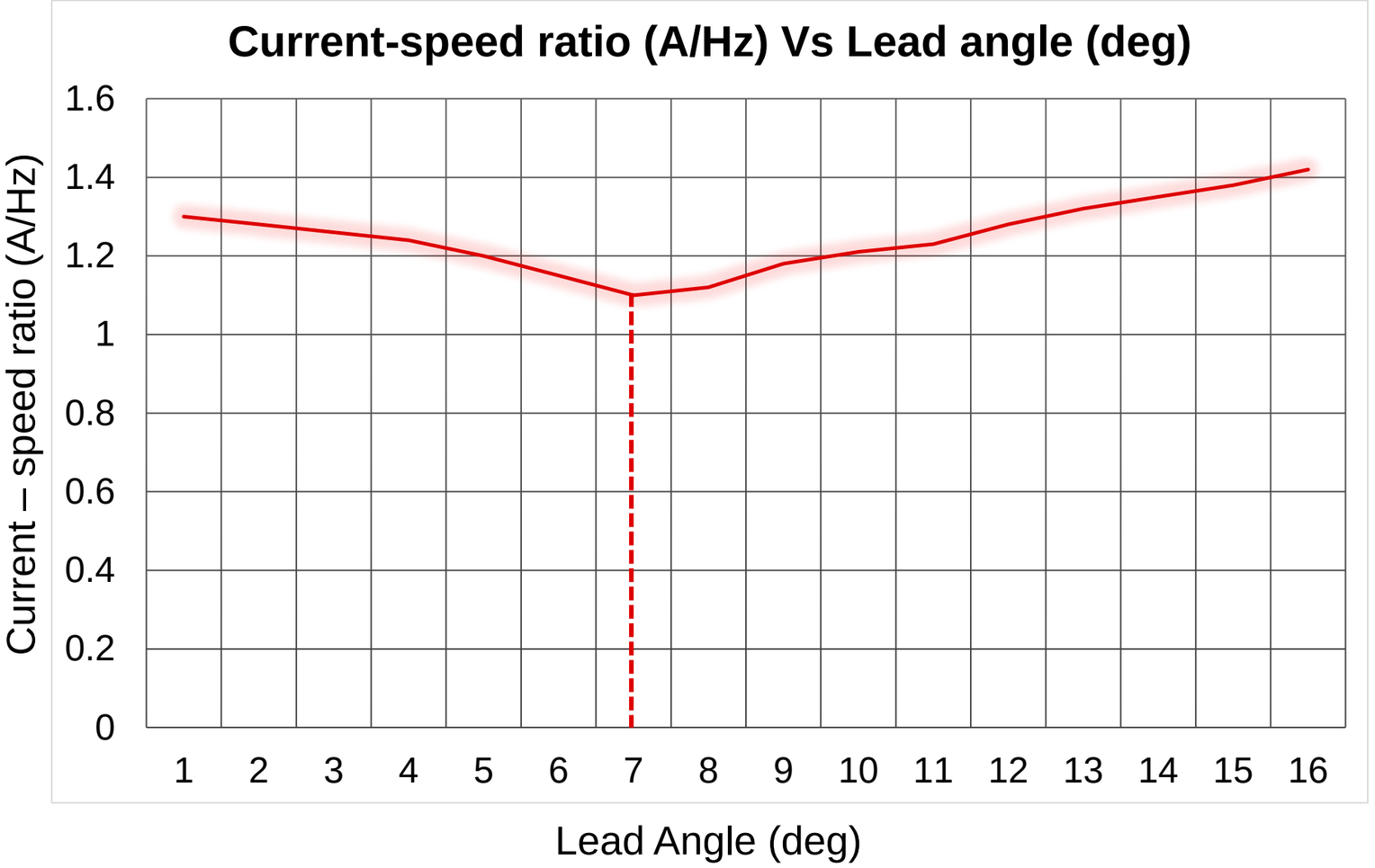
How to tune lead angle in sensored motors?

- Ensure hall signals of all three phases are aligned with their respective BEMF voltages.
- Monitor motor current and Hall signal of one of the motor phases.
- Tune lead angle until the phase current is aligned with Hall signal.
- Optimum efficiency is achieved at the lead angle where phase current is aligned with Hall signal.



How to tune lead angle in sensorless motors?

- Measure phase current and speed of the motor for a wide range of lead angles.
- Calculate phase current over speed ratio.
- Plot phase current over speed ratio Vs lead angle.
- Optimum value is when the current speed ratio is minimum.



To find more Motor Driver technical resources and search products, visit

ti.com/motor-drivers.