

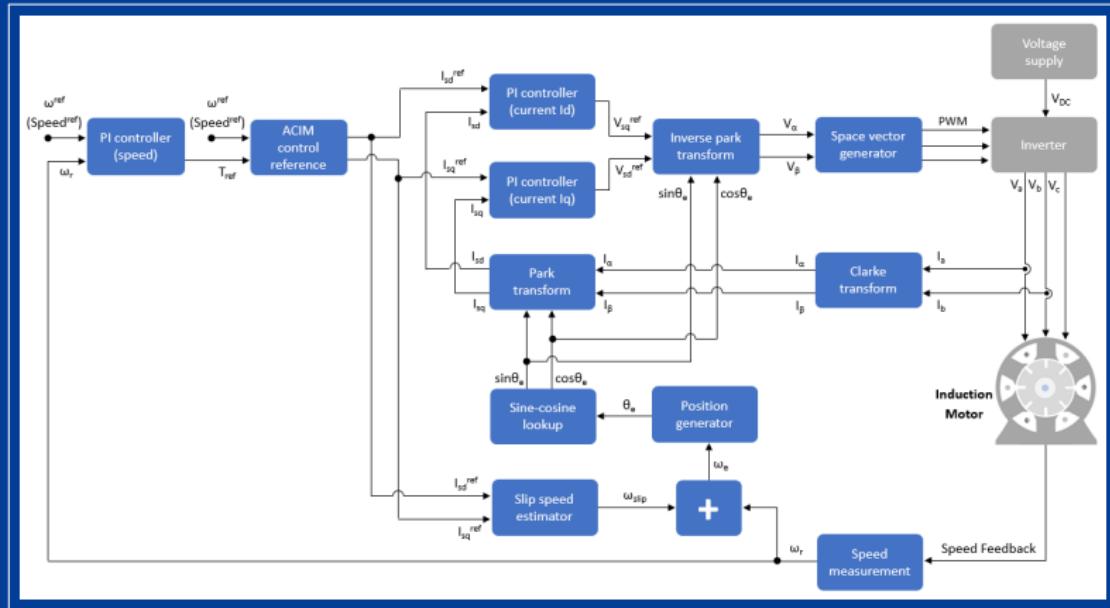
D.S.P. based Field Oriented Control of Induction motor

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Anabhayan S P 200901008

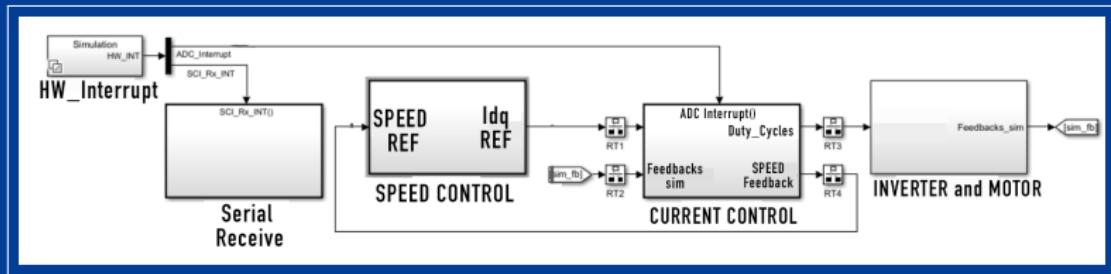
Under the guidance of Dr S Rama Reddy
Dean - Electrical sciences

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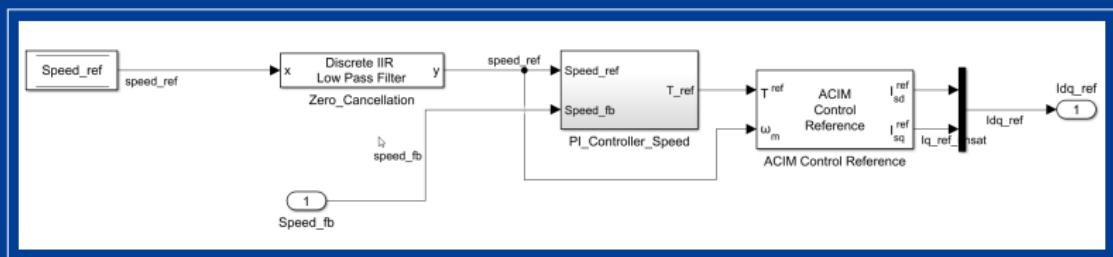
Block Diagram of Field Oriented Control



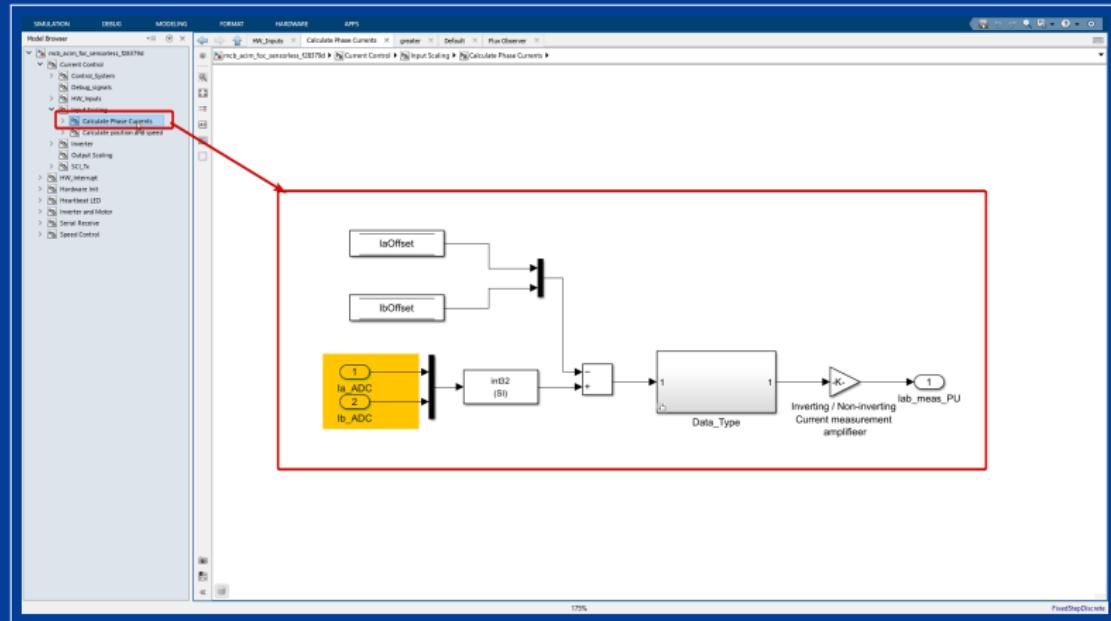
Block Diagram of the System



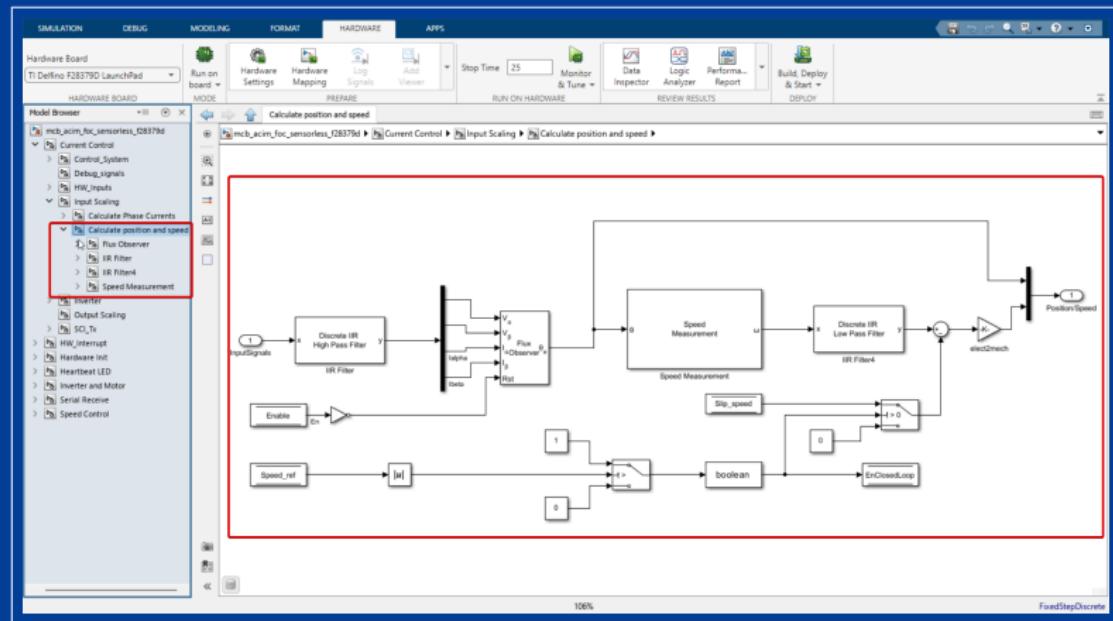
Speed Control Subsystem



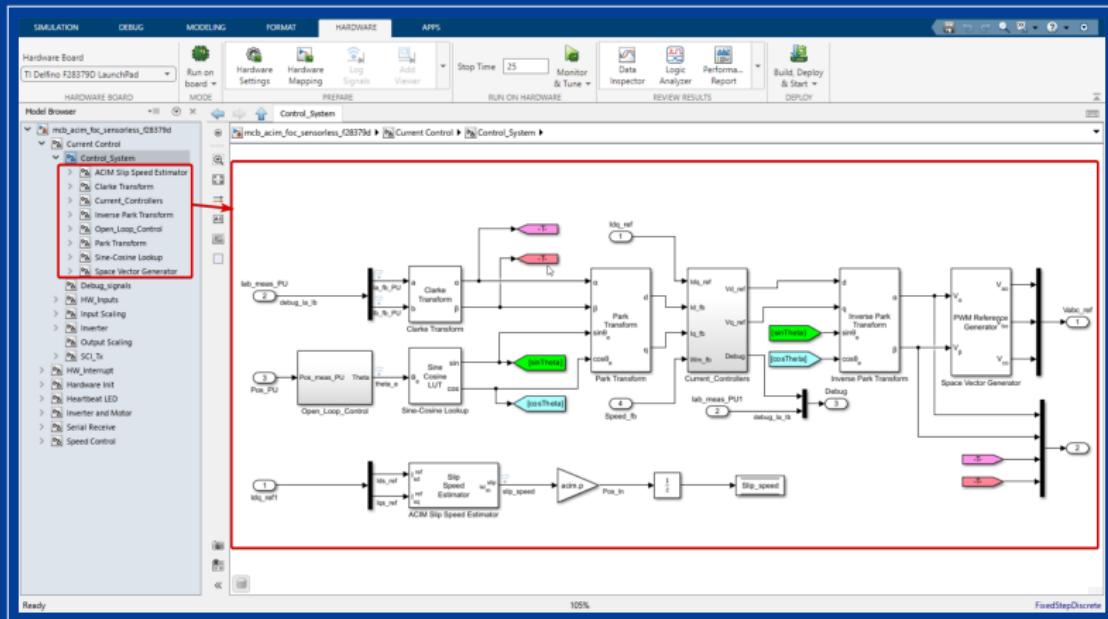
Current Measurement



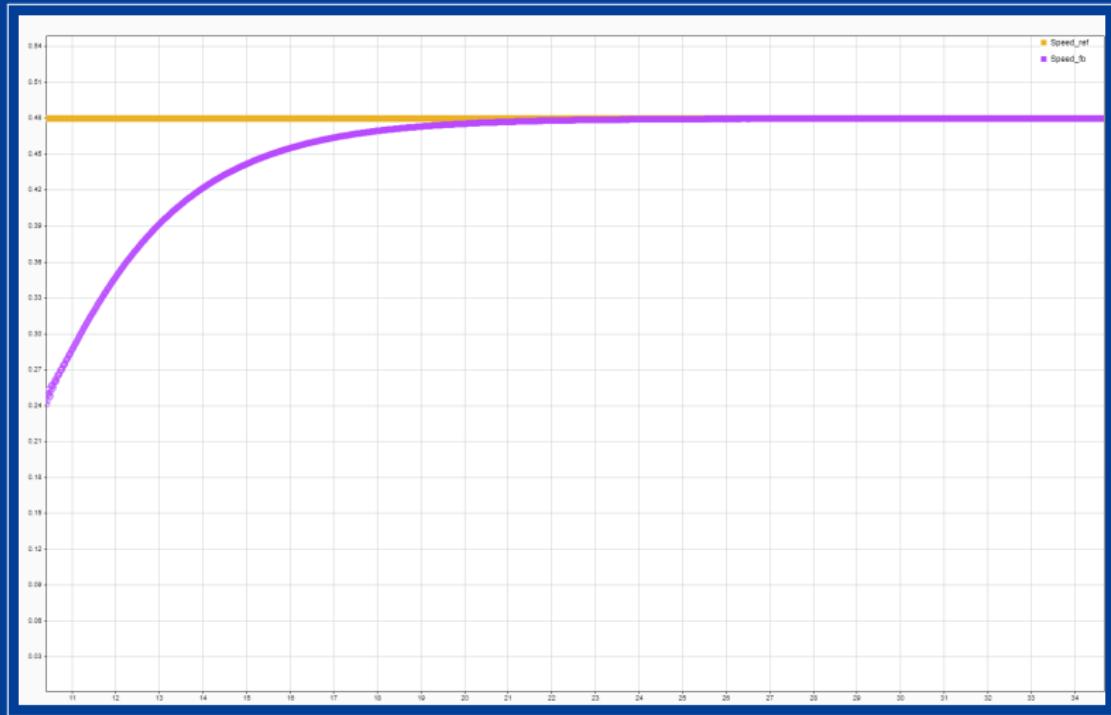
Position and Speed Estimation



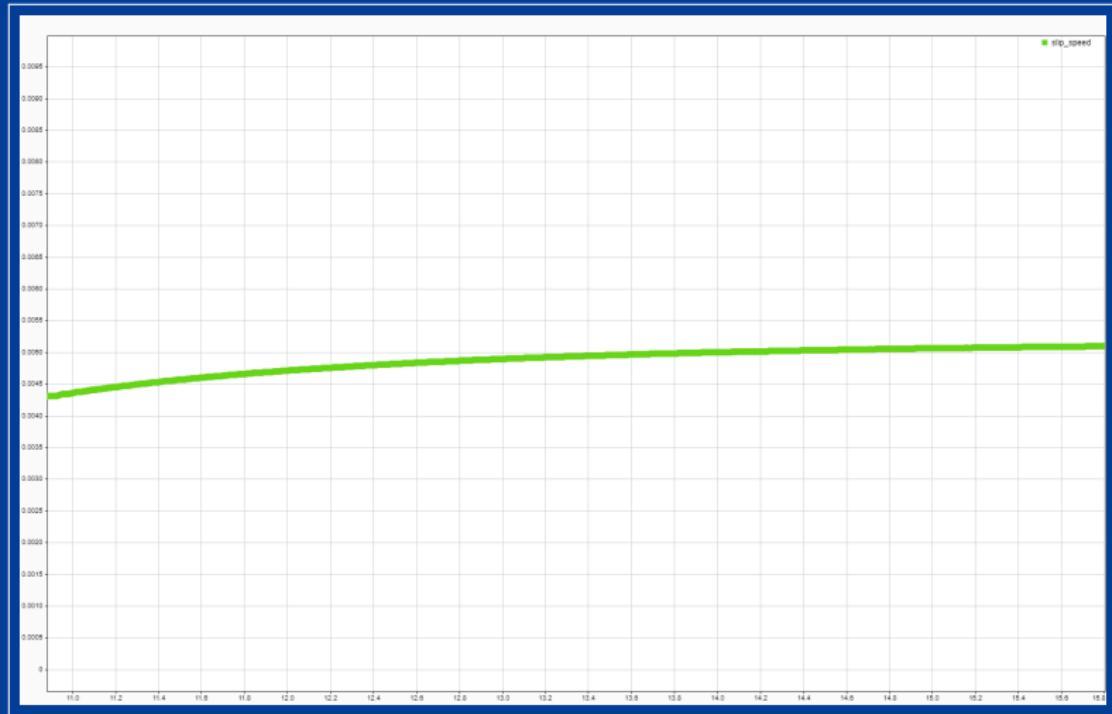
Current Control System



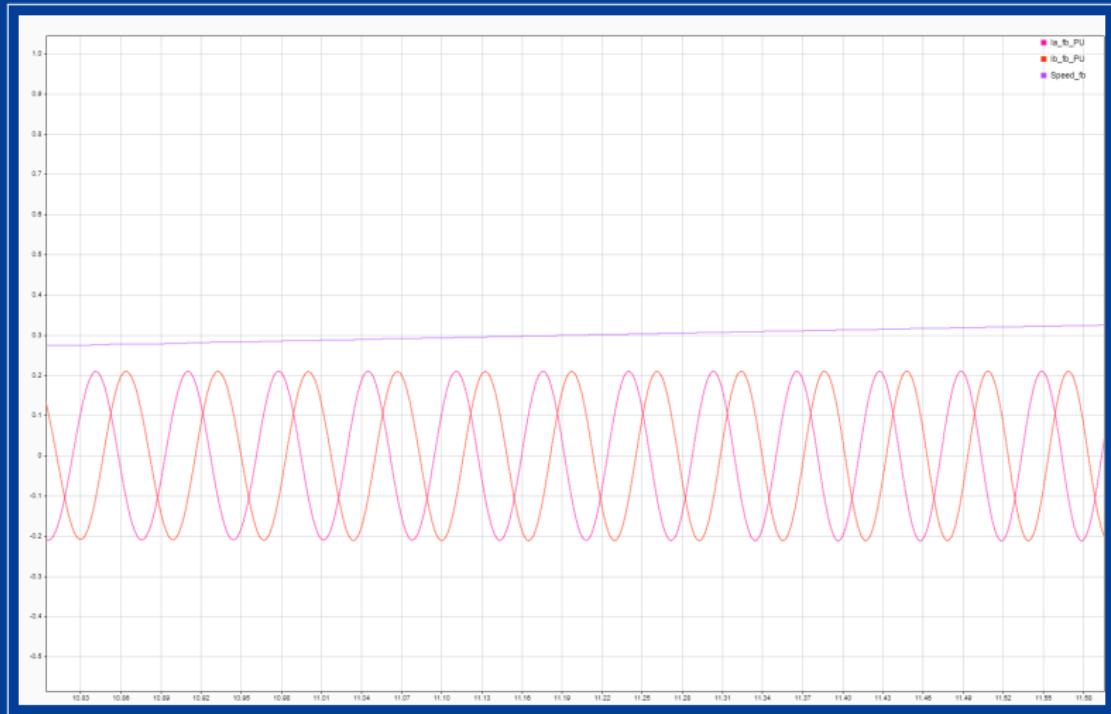
Speed Response



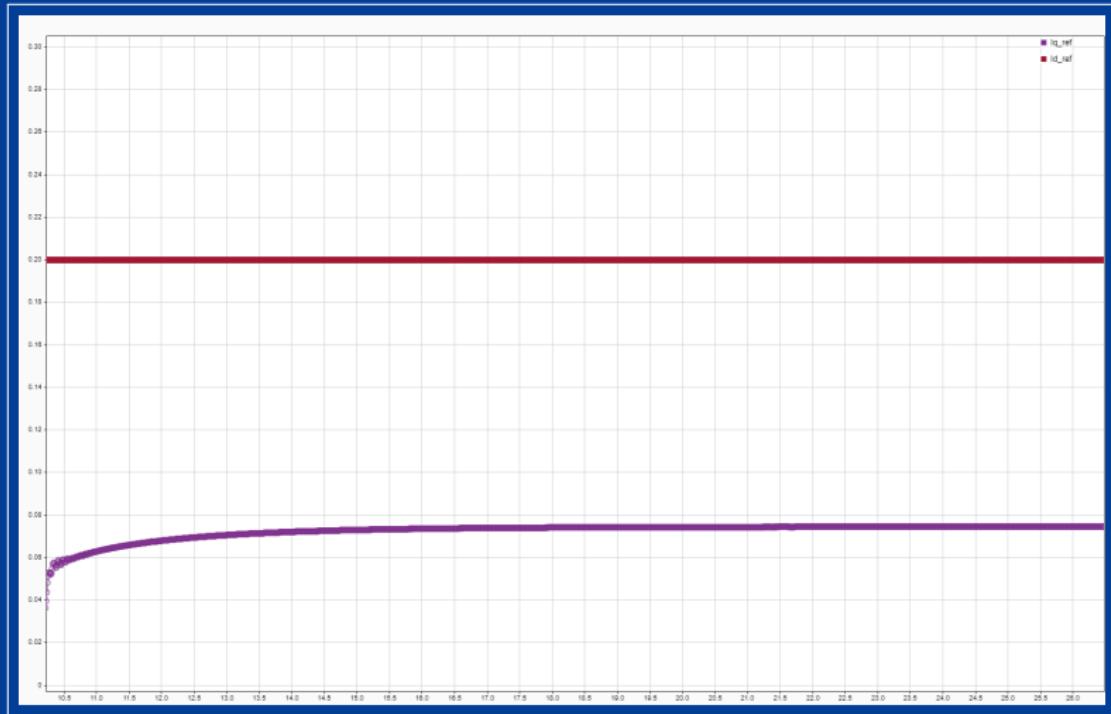
Slip Speed



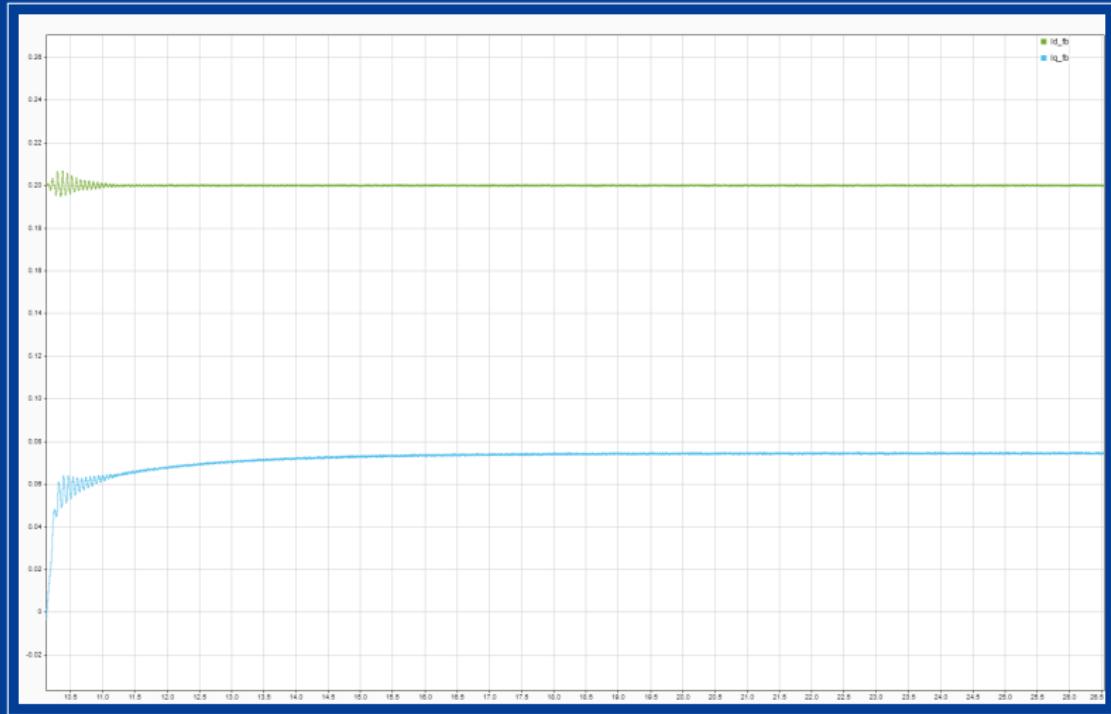
Ia and Ib Feedback/Measured Currents



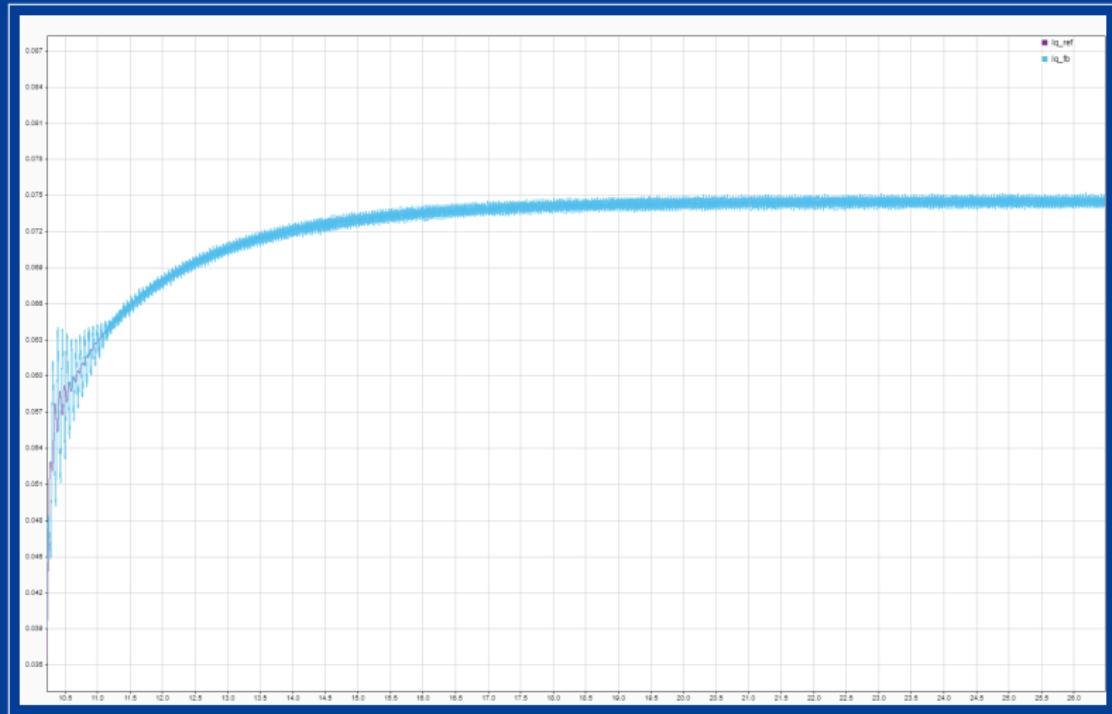
Id and Iq Reference Currents



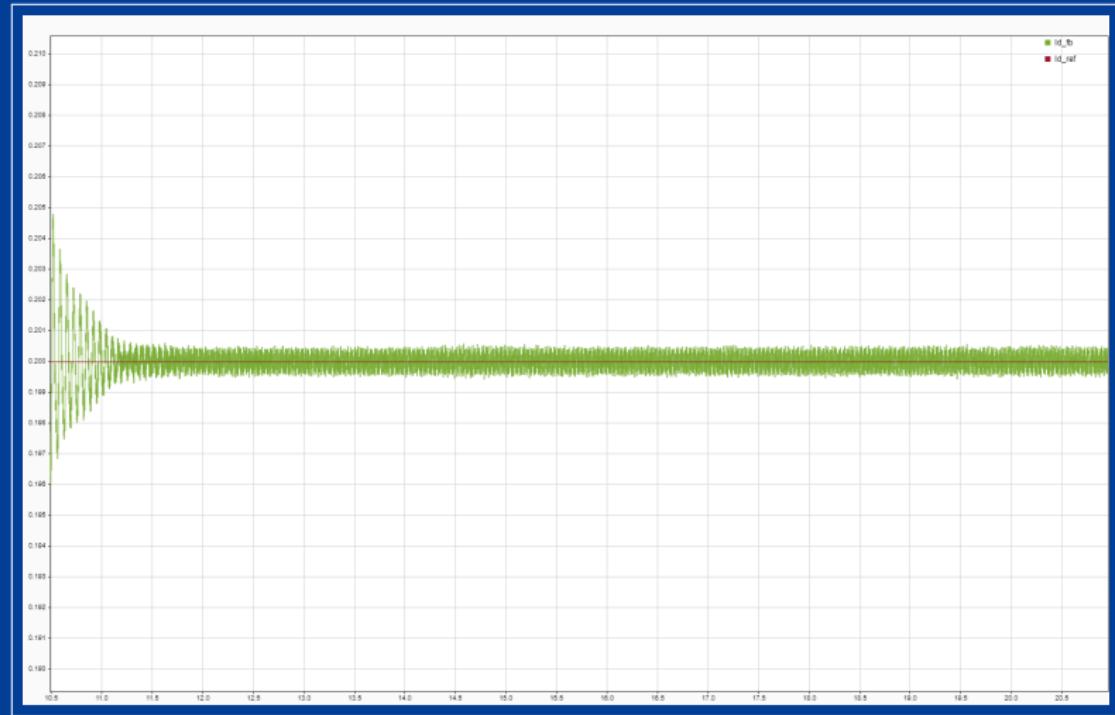
Id and Iq Feedback Currents



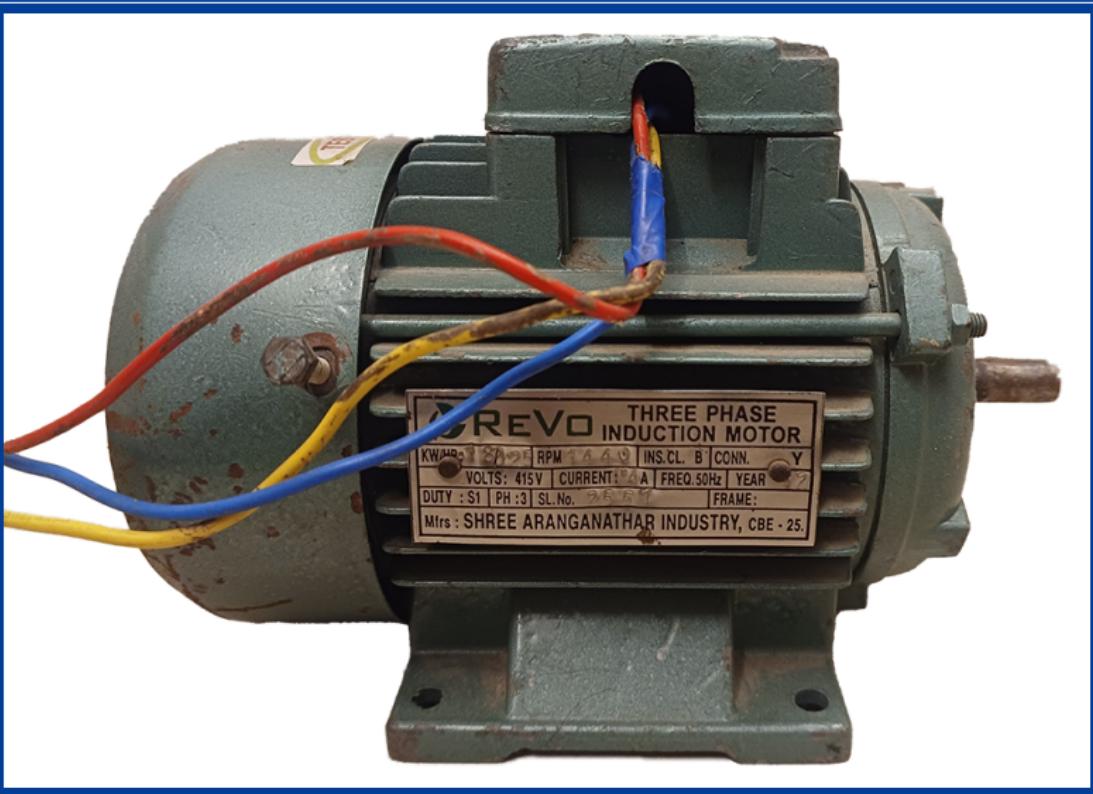
Iq Reference and Feedback Currents (Torque producing current)



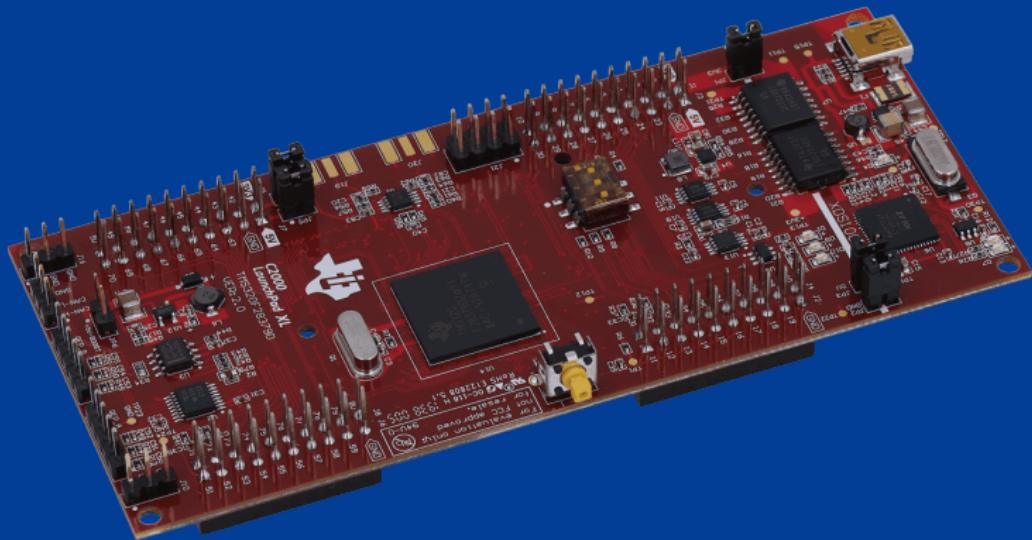
Id Reference and Feedback Currents (Magnetizing current)



Induction Motor



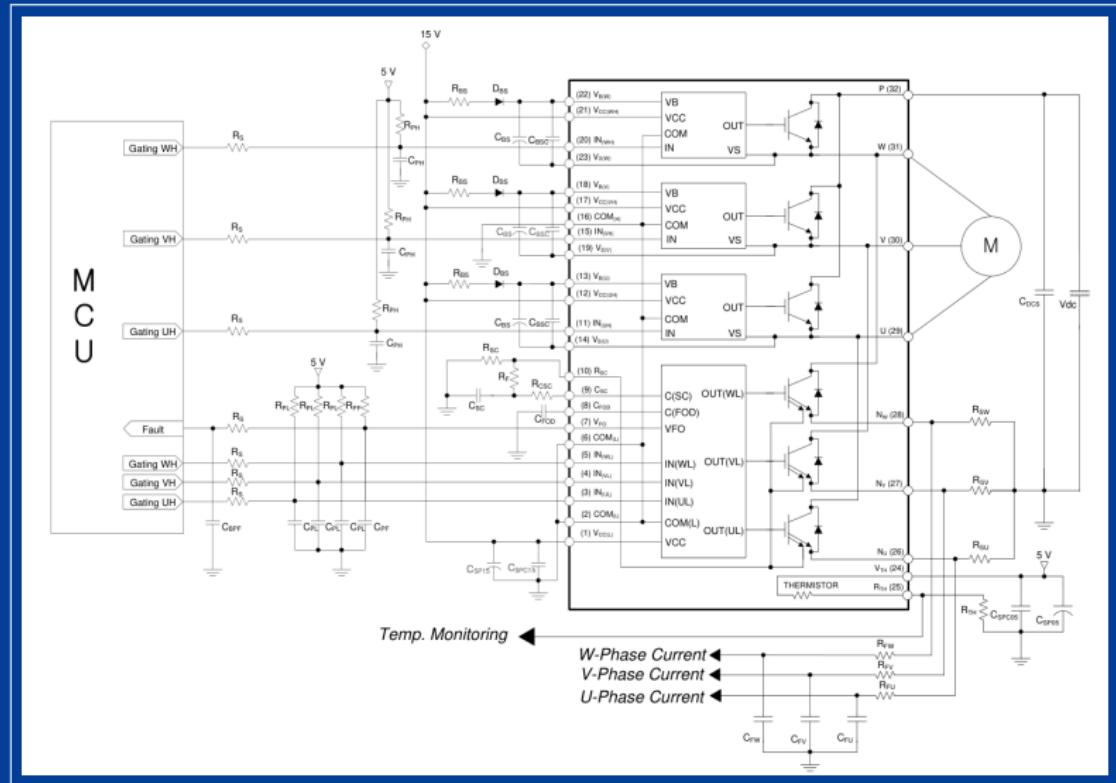
F23879d Launchpad



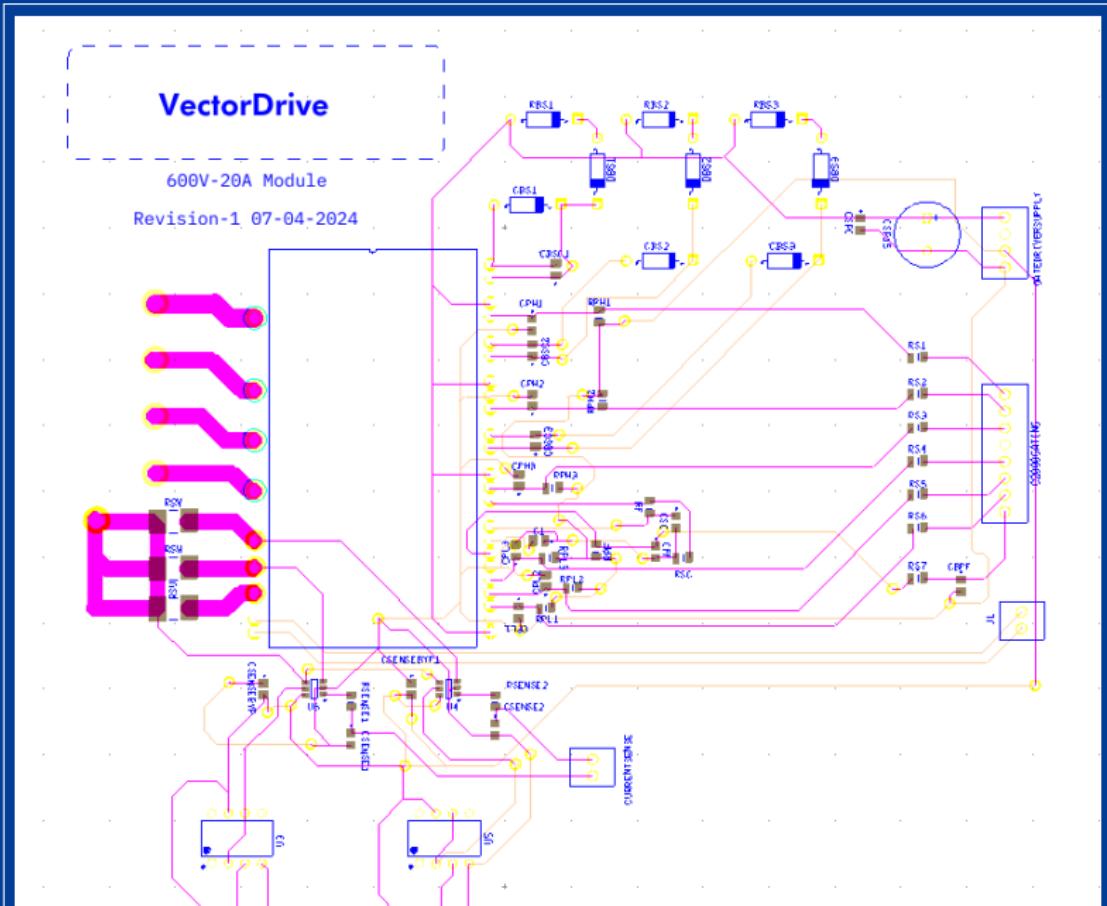
Intelligent Power Module Fsam20sh60a



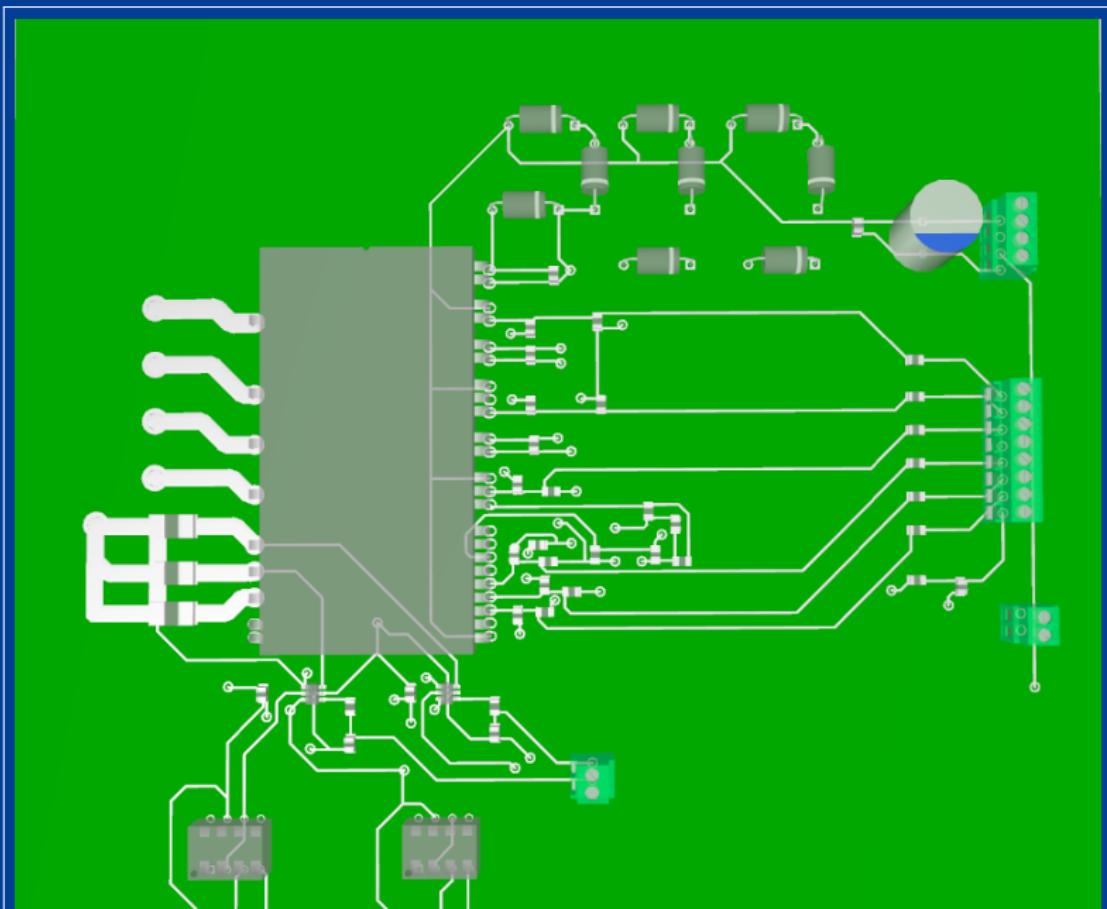
PCB Design



PCB Layout Design



3D View of PCB Layout



Current Measurement

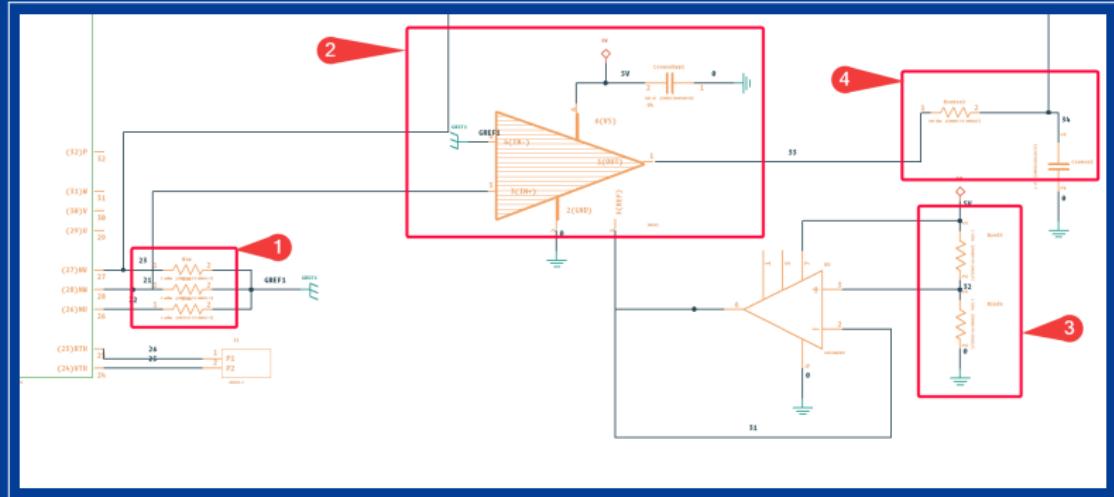


Figure: Current Sensing Circuit in Multisim (one phase shown)

ACIM Parameter Estimation: No-Load Test



Figure: No-load test setup

Fluke 434 Power Analyzer



Figure: Fluke 434 power analyzer

No-load Test Circuit

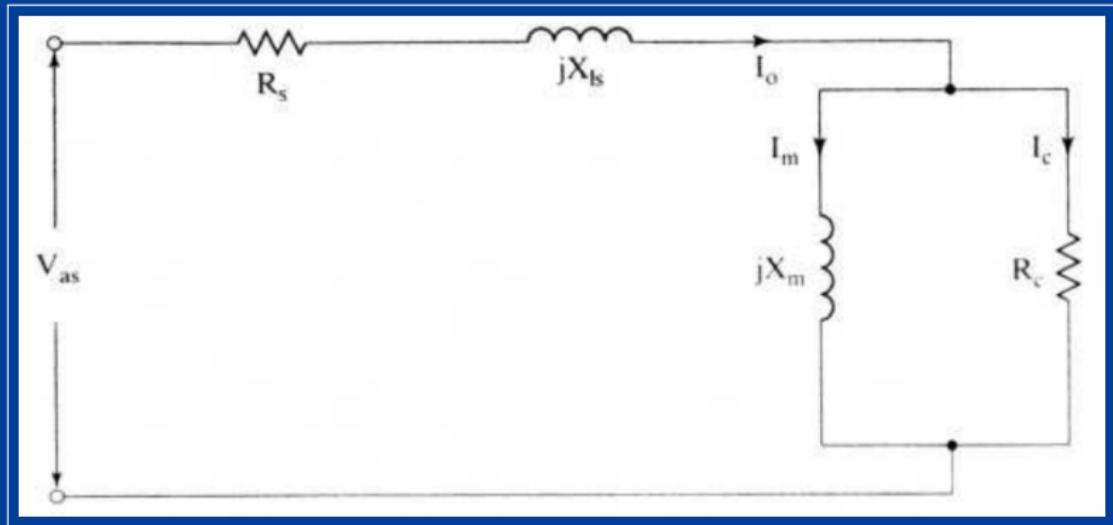


Figure: No-load test circuit

ACIM Parameter Estimation: Blocked Rotor Test

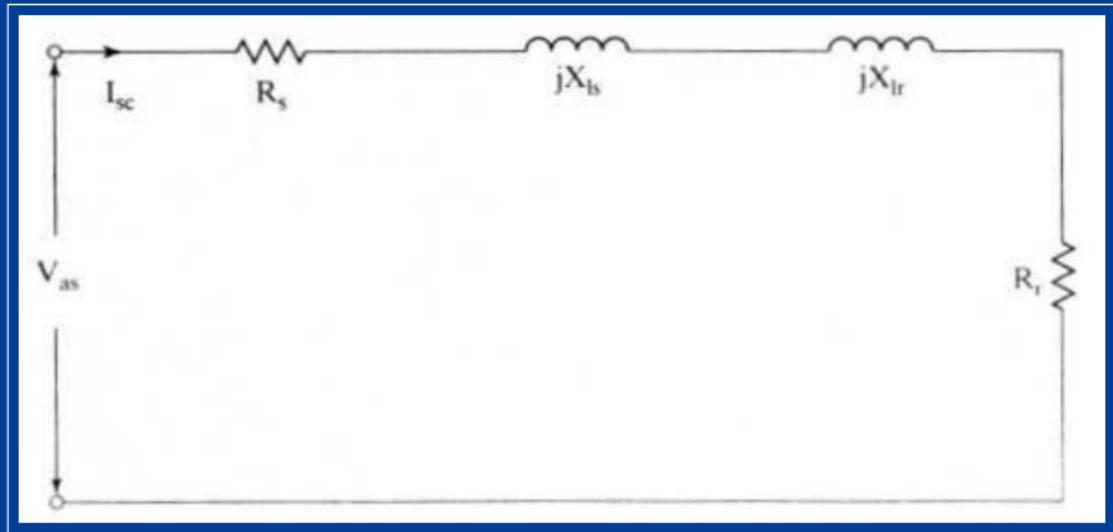


Figure: Blocked rotor test circuit

Space Vector Pulse Width Modulation



Figure: ePWM block in Simulink

TBPRD Calculation

- ▶ PWM Frequency (F_{PWM}):
15 kHz (recommended by
FSAM20SH60A datasheet)
- ▶ System Clock (SYSCLK):
200 MHz
- ▶ High Speed Clock Divider
(HSPCLKDIV): 1
- ▶ Clock Divider (CLKDIV): 1

$$T_{PWM} = \frac{1}{F_{PWM}}$$

$$T_{TBCLK} = \frac{SYSCLK}{HSPCLKDIV \times CLKDIV}$$

$$TBPRD = \frac{T_{PWM}}{2 \times T_{TBCLK}}$$

$$T_{PWM} = \frac{1}{15 \times 10^3} \text{ seconds}$$

$$T_{TBCLK} = \frac{200 \times 10^6}{1 \times 1} = 200 \times 10^6 \text{ Hz}$$

$$TBPRD = \frac{\frac{1}{15 \times 10^3}}{2 \times 200 \times 10^6} \approx 6667$$

Therefore, the Timer Period (TBPRD) is 6667.

ePWM Configuration

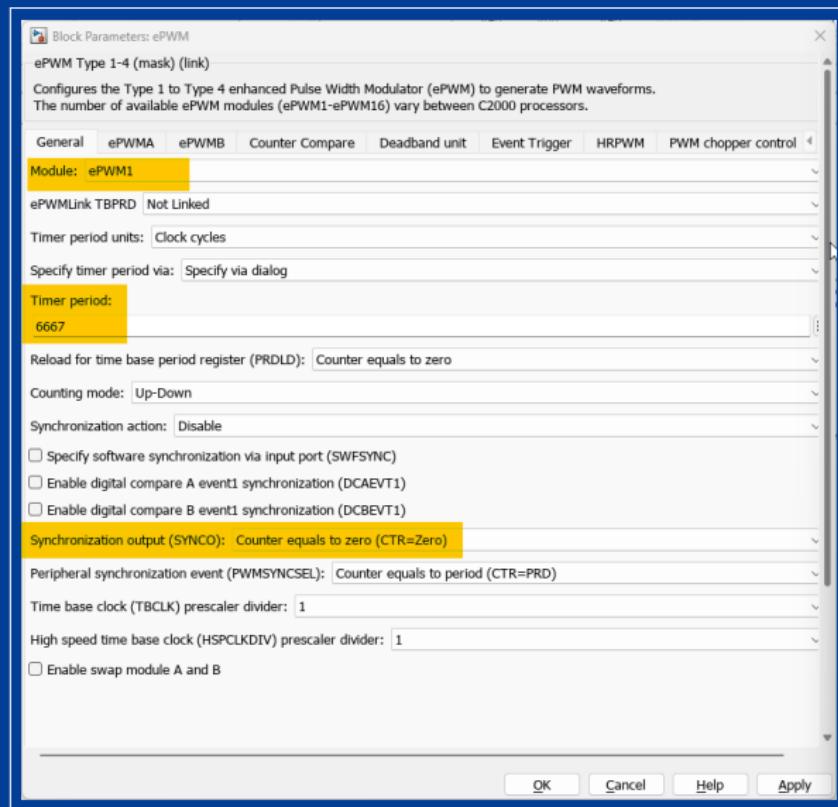


Figure: ePWM configuration in Simulink

SVPWM with Low Pass Filter

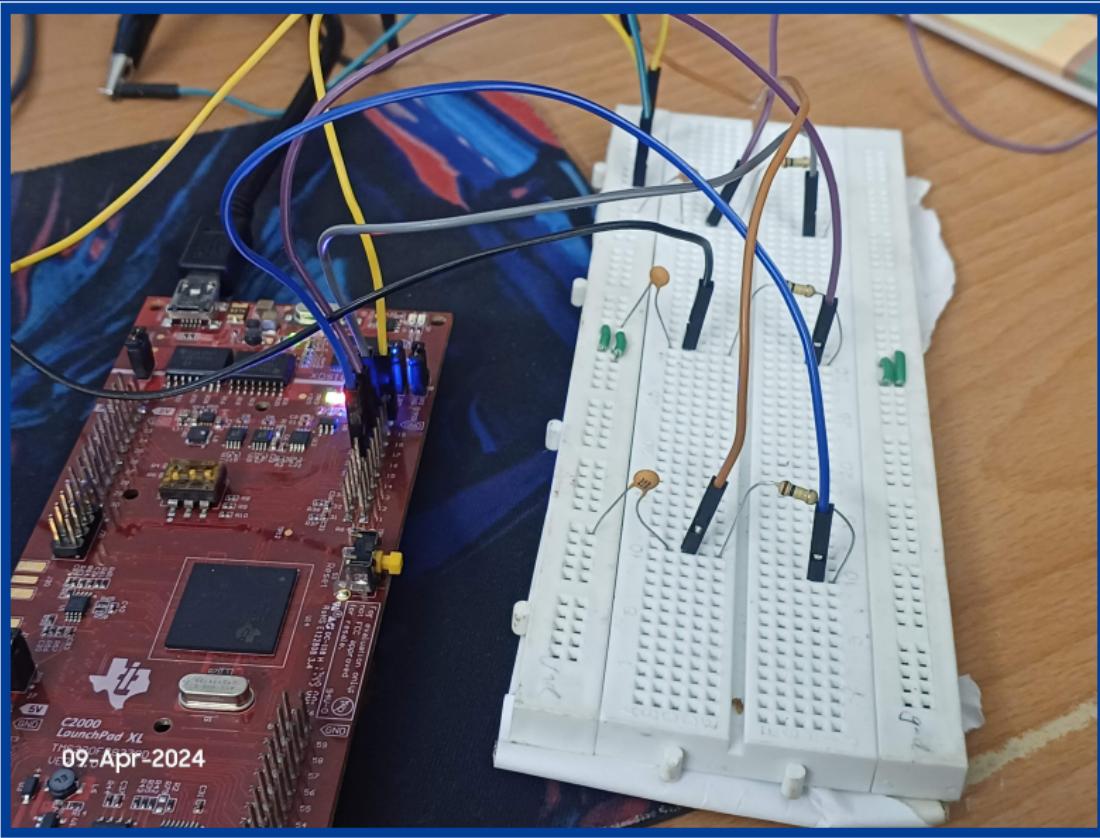


Figure: Hardware setup with RC filter and Launchpad

Output of SVPWM with LPF

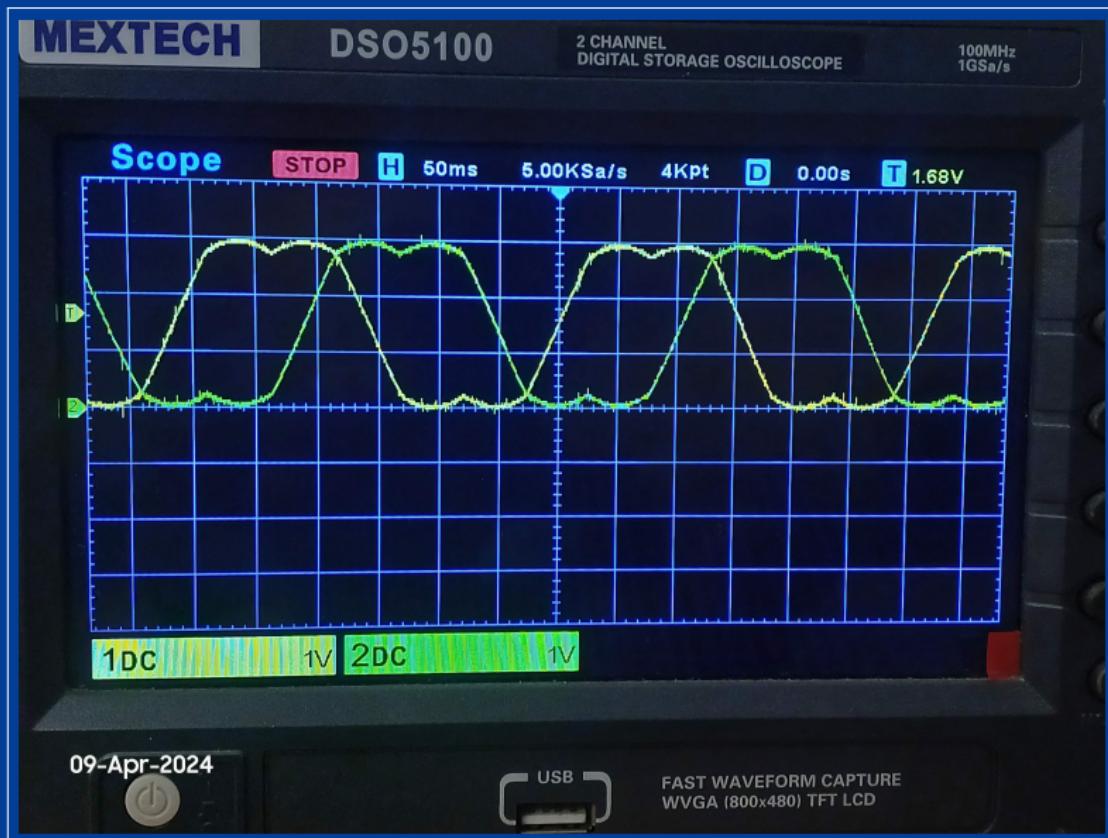


Figure: Output of SVPWM with low pass filter

Dead Band Implementation

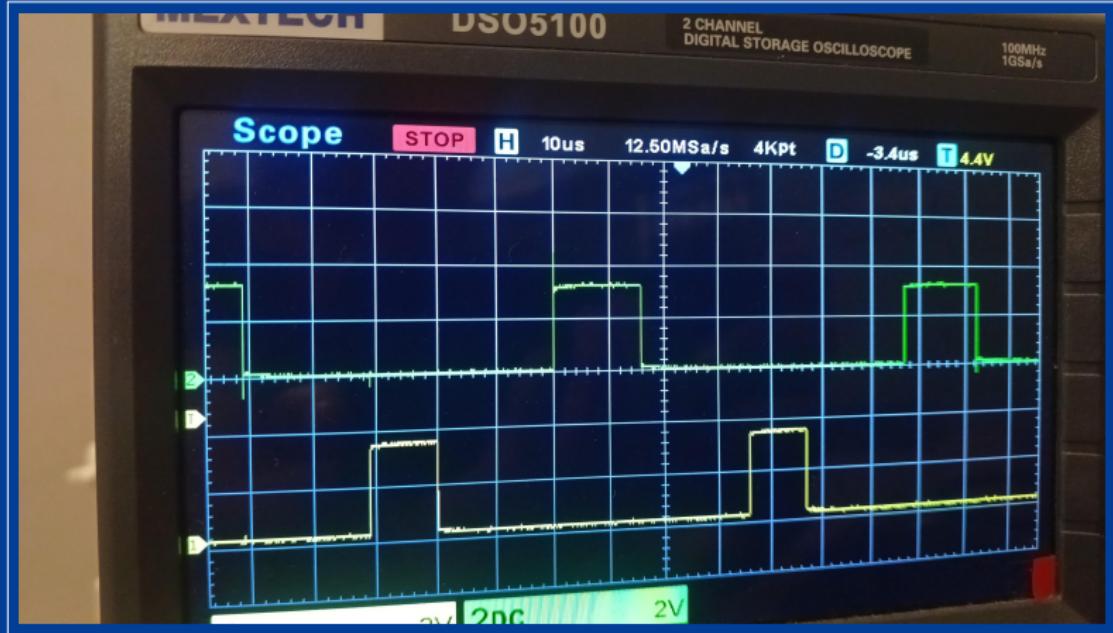


Figure: Dead band time