Motor Control

- Motor control is open-loop
- User throttle monotonically increases power
  - Controlled as BLDC motor
- Two options to change throttle
  - Alter boost output voltage
  - Alter duty cycle of motor drive

Motor Driver: Trapezoidal Control

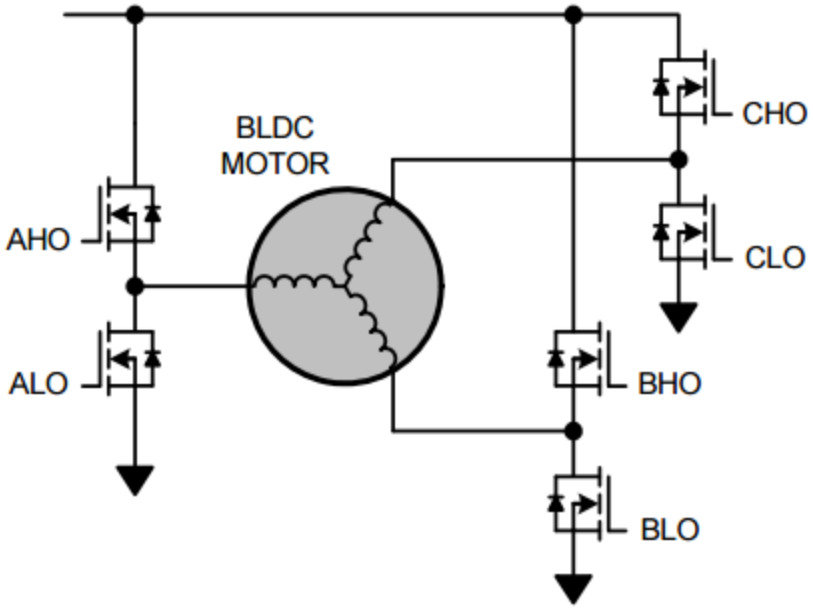


FIGURE 3. BASIC BLDC MOTOR POWER TOPOLOGY

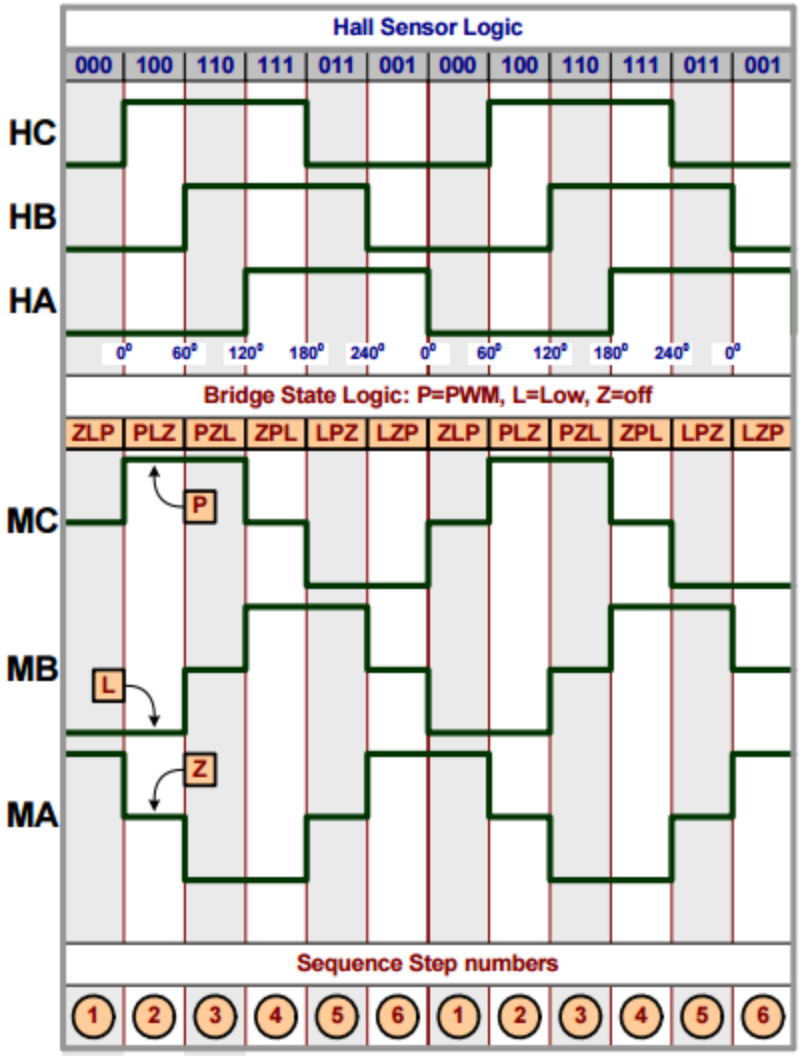


FIGURE 4. HALL SENSOR LOGIC vs BRIDGE STATE LOGIC

Trapezoidal Control: HF PWM

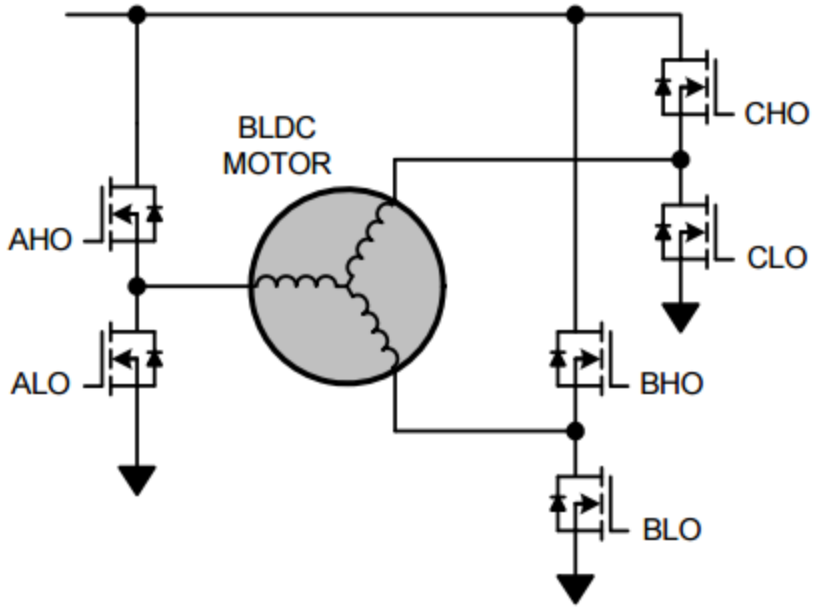


FIGURE 3. BASIC BLDC MOTOR POWER TOPOLOGY

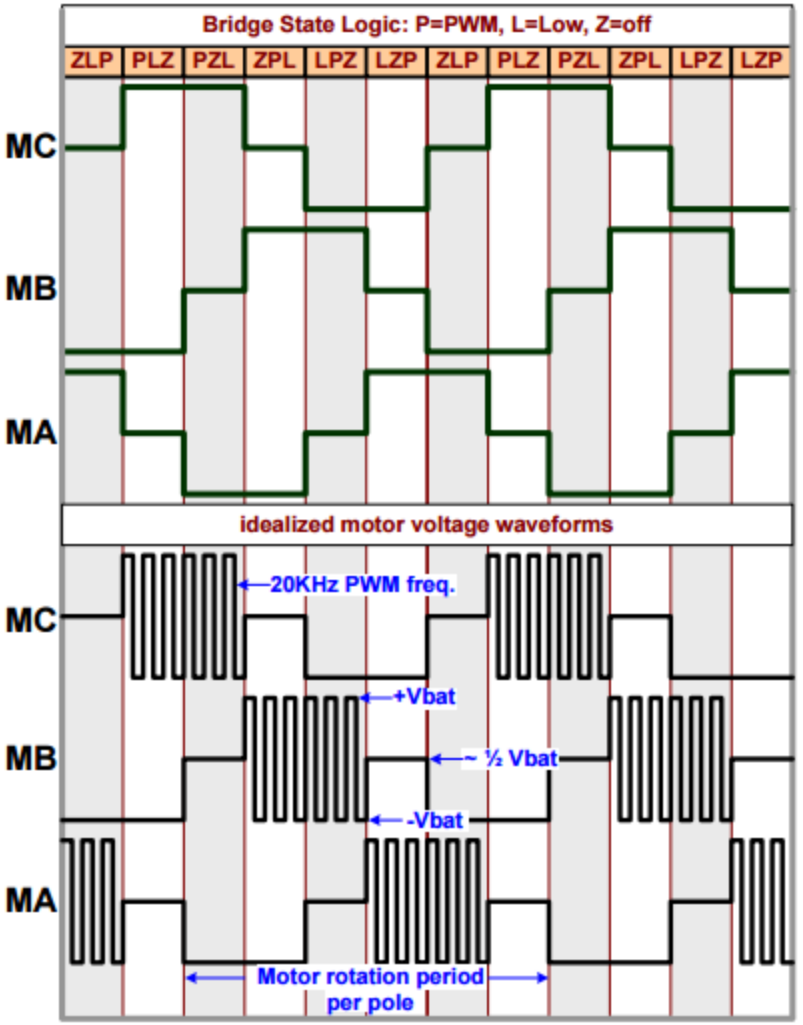
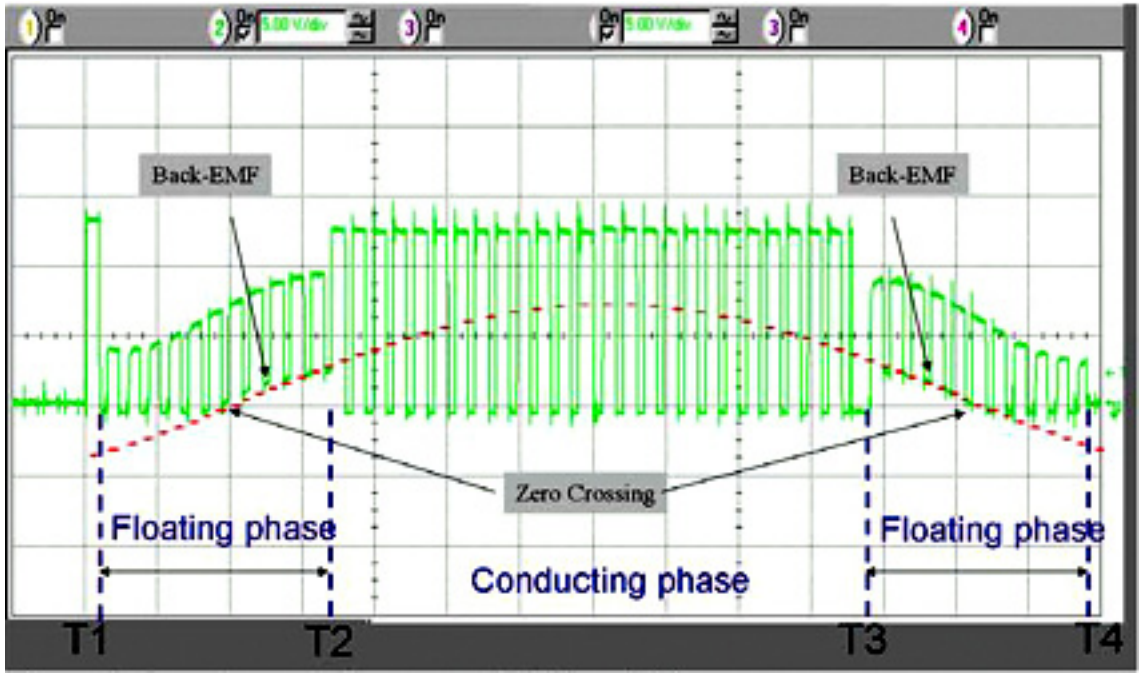
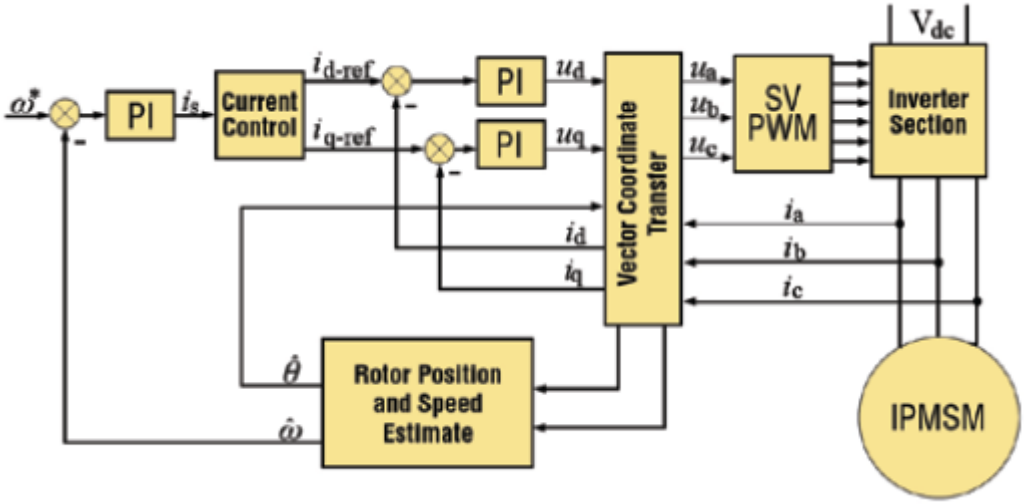


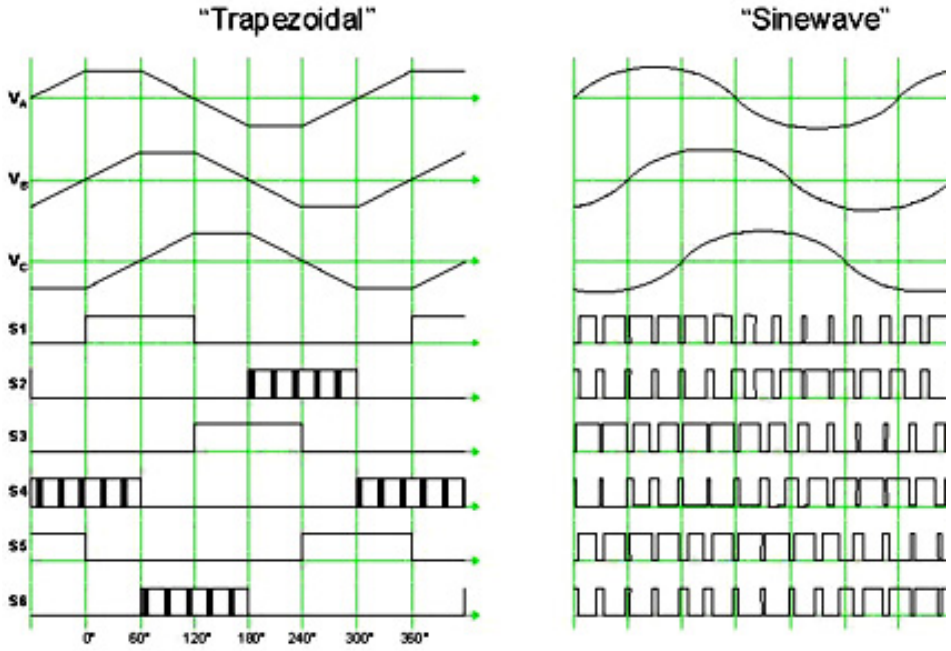
FIGURE 5. BRIDGE STATE LOGIC vs MOTOR VOLTAGE

A Note: Reflected Voltages



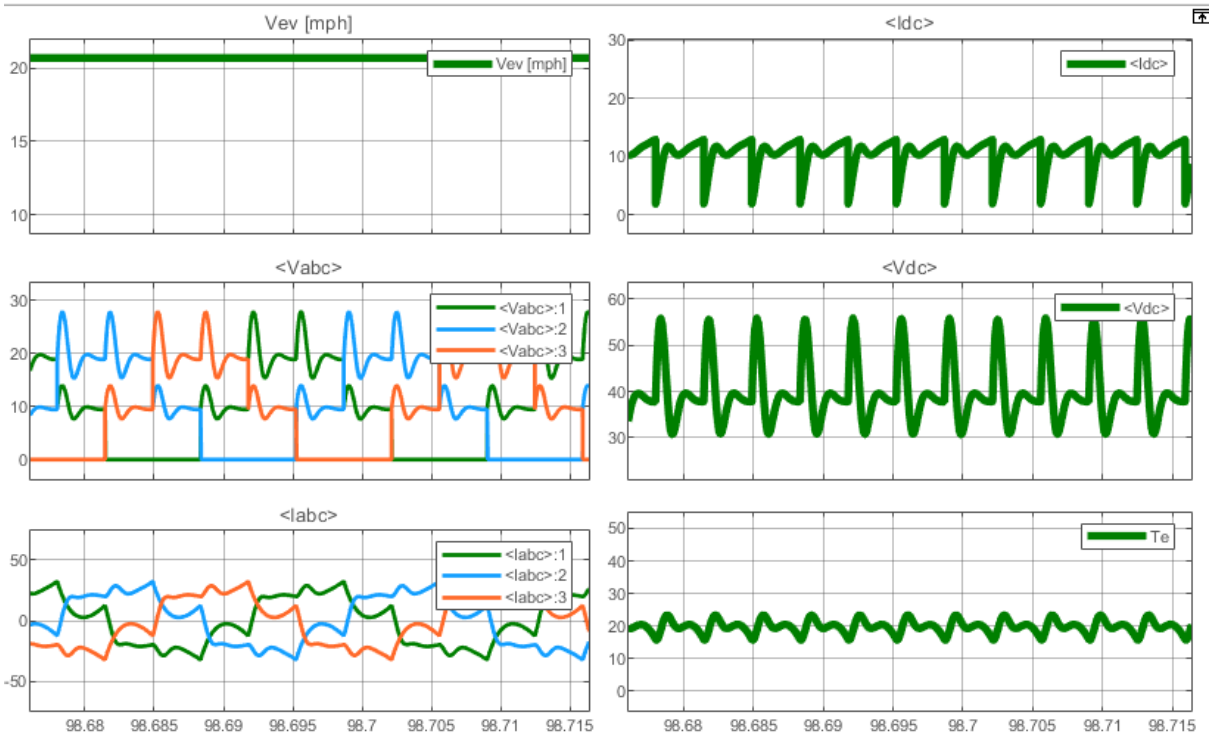
Sinusoidal (Vector) Control





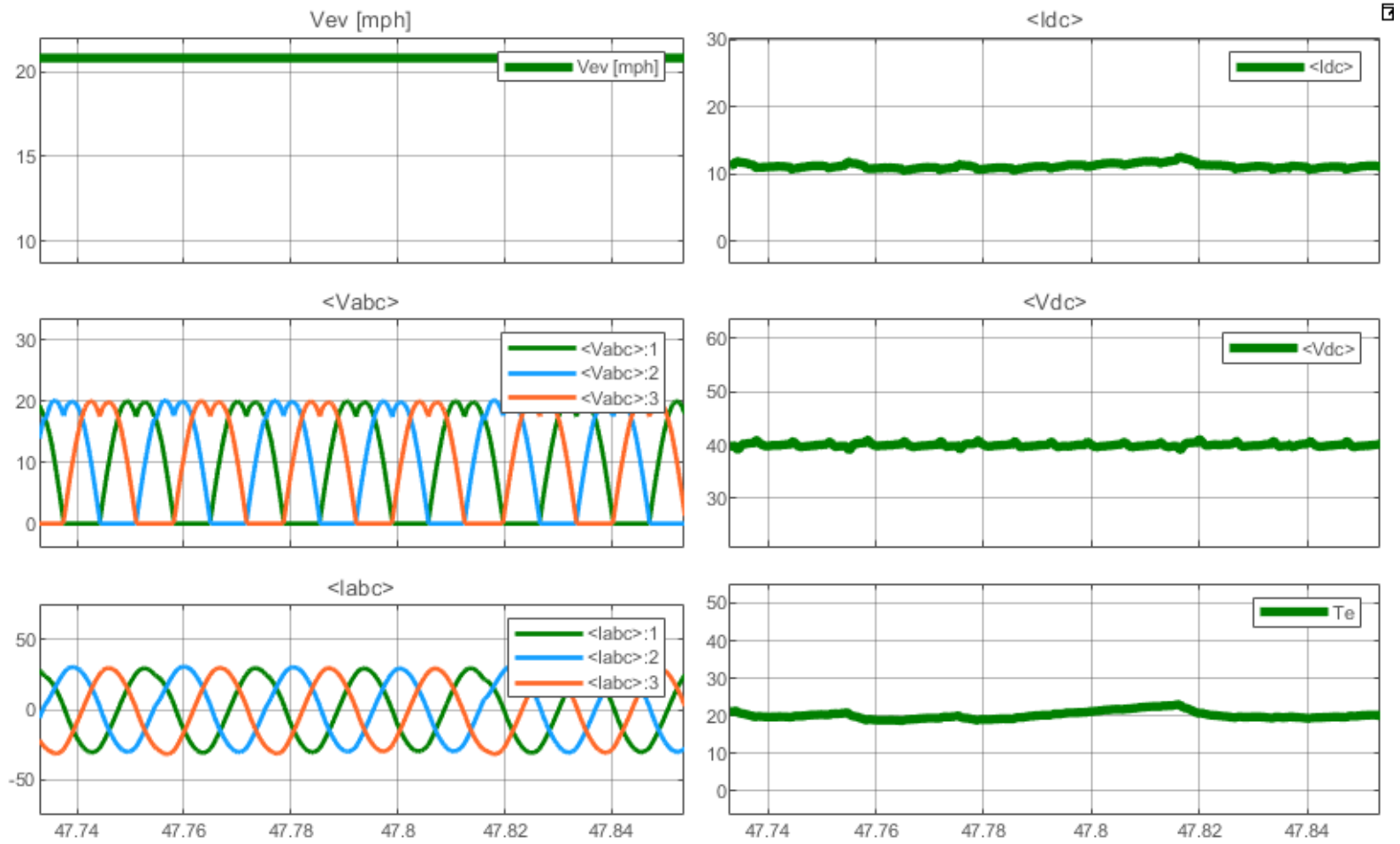
DC Bus Ripple – Trapezoidal Control

- C_{DC} = 100µF

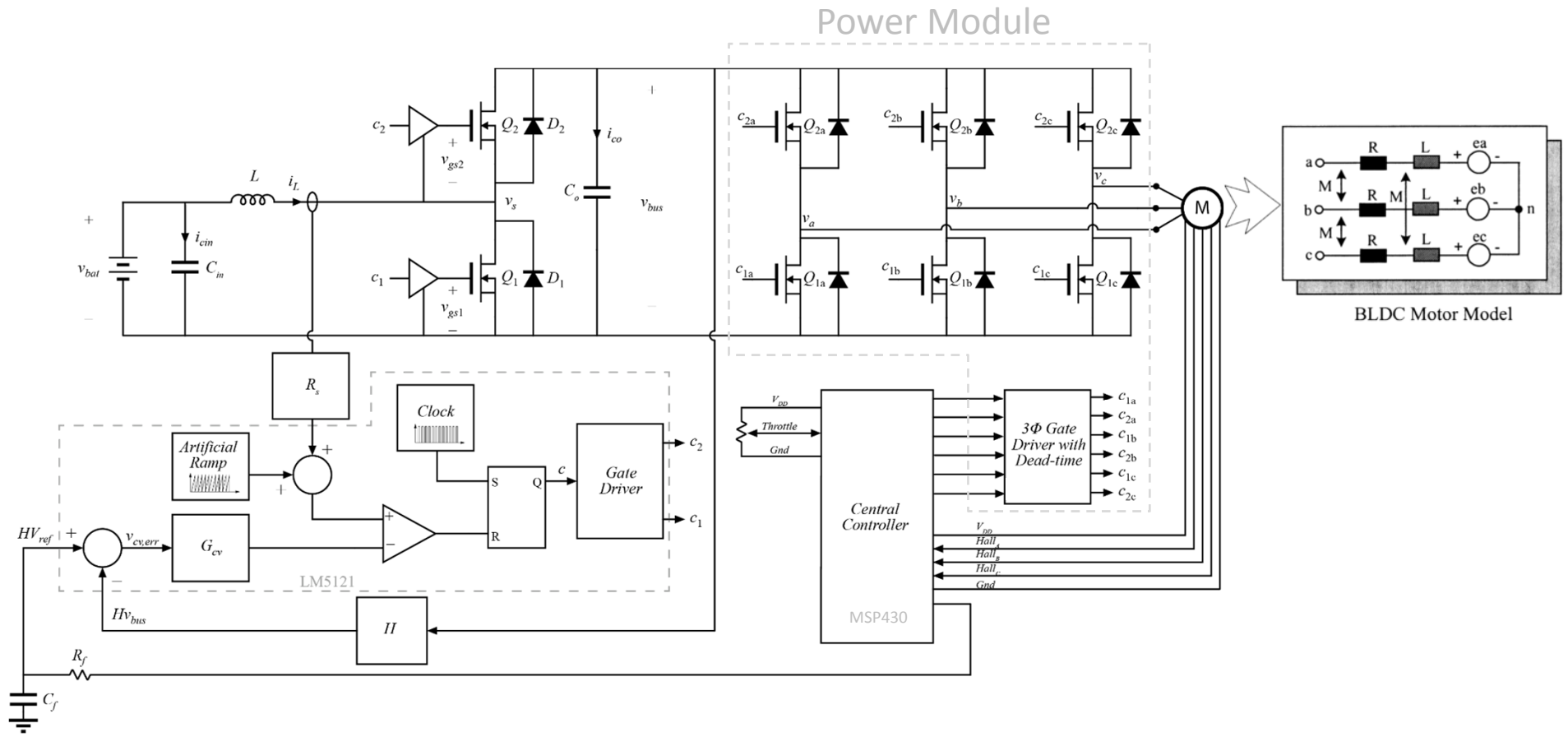


DC Bus Ripple – Sinusoidal Control

- C_{DC} = 100µF



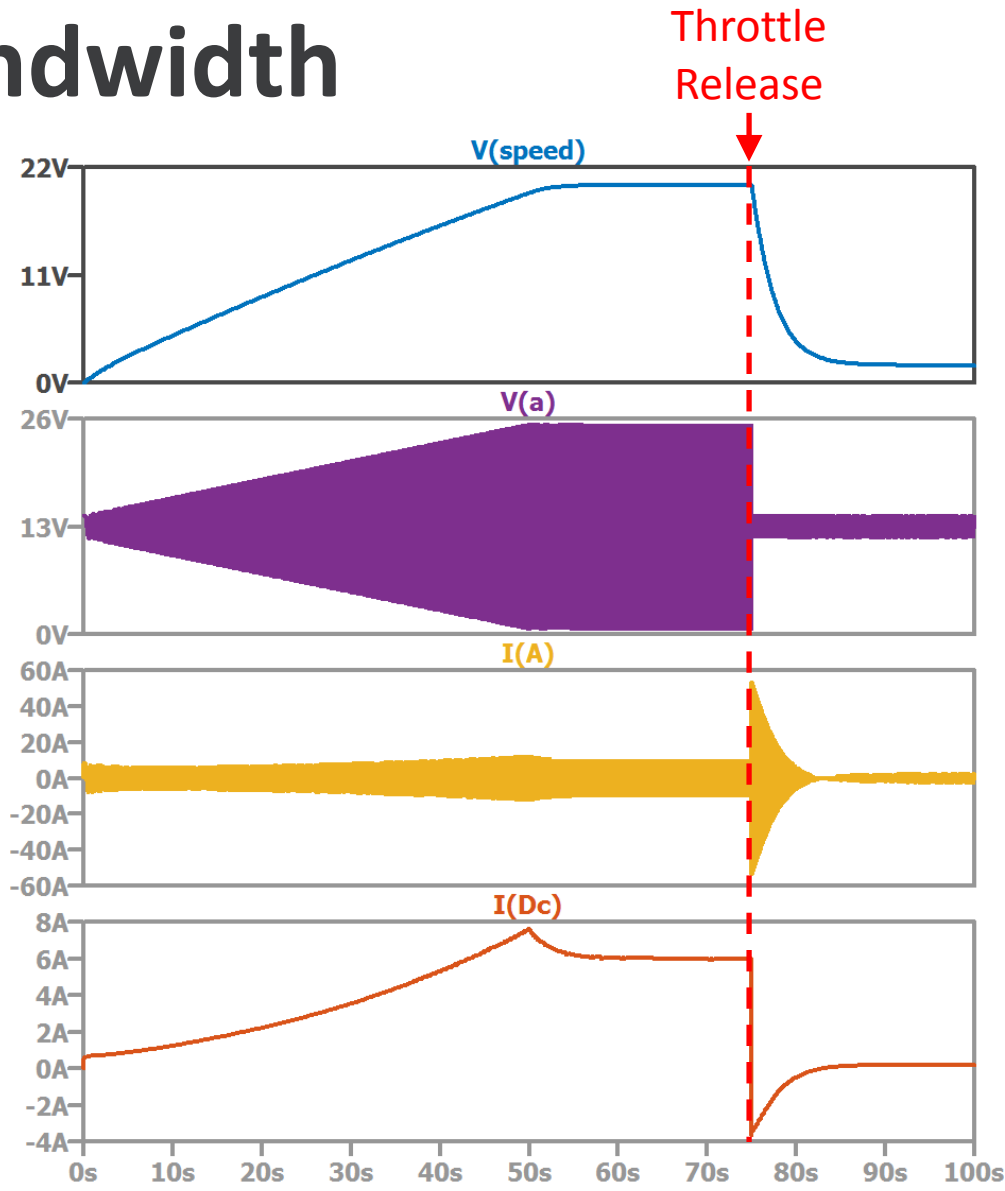
Reference Filtering



Motor Control Bandwidth

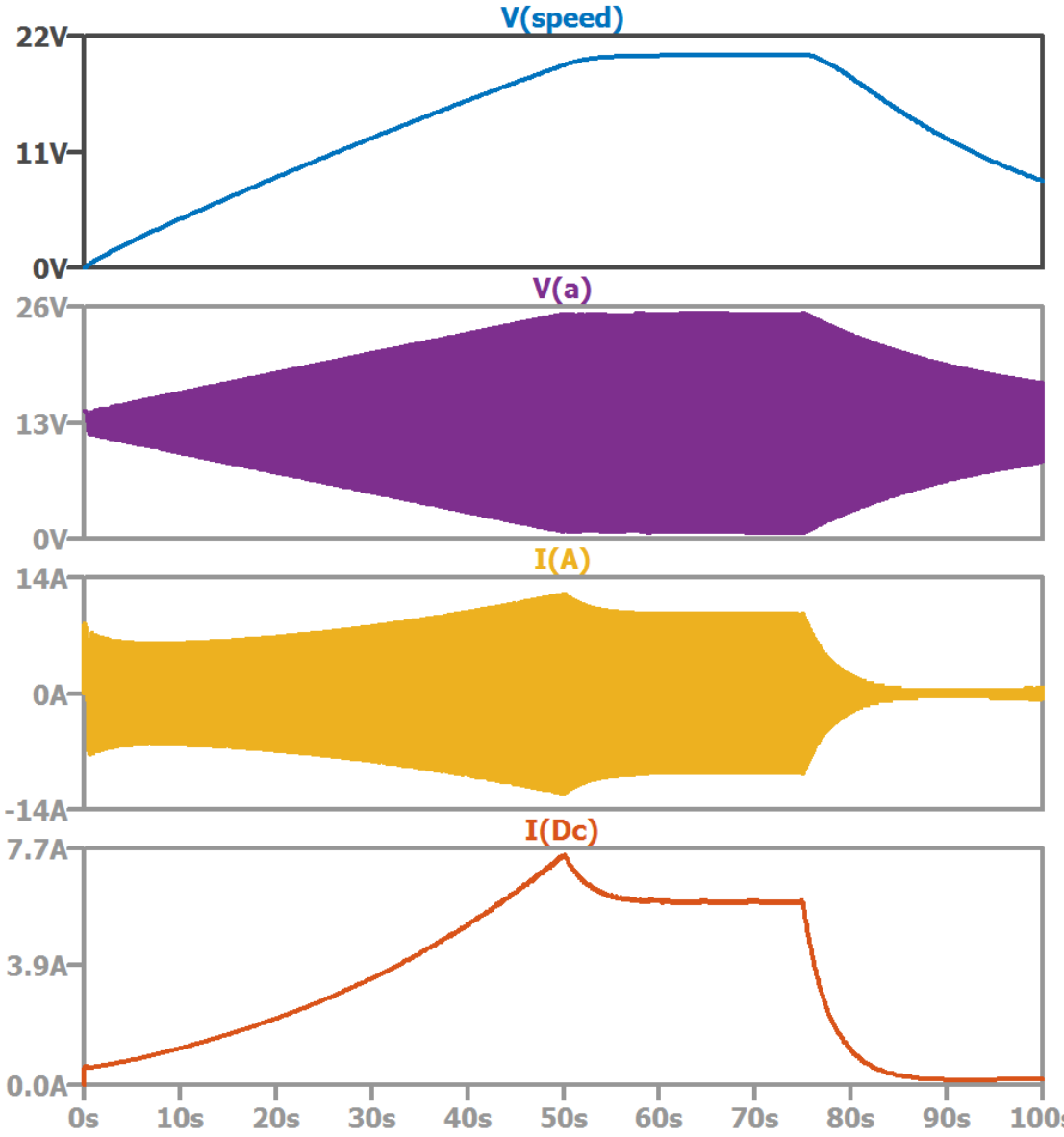
No Filter

May require braking circuit



Motor Control Bandwidth

f_c = 8 mHz + antiparallel diode



Motor Drive

- Power Stage
  - Power module
    - Integrated devices, and/or drivers
    - 3Φ bridge (e.g. MTI85W100GC, IRAM136-3023B)
    - Half bridge (e.g. SQJ974EP, IPG20N10S4L)
  - Individual FETs
- Controller
  - Allegro A4915
  - Toshiba TB6551FAG
  - TI DRV8308
  - Other options
- Example Schematics in Starter Files for Experiment 5