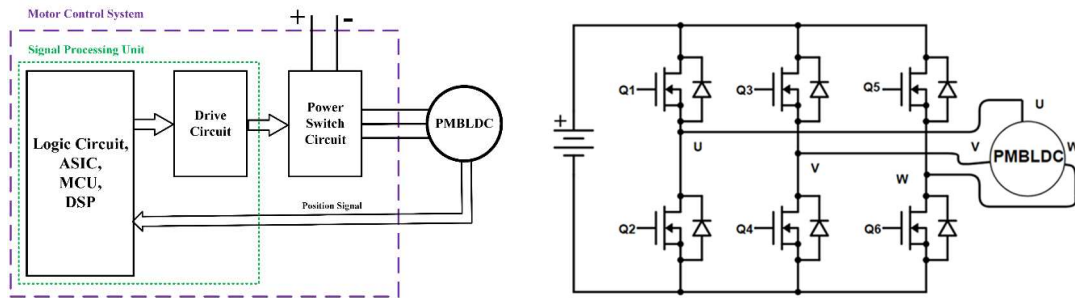


MOTOR CONTROL – PART 1

TYPES OF POWER ELECTRONIC SWITCHES

Power electronic switches (PES) are part of drive used to control speed and torque of BLDC motors. By controlling PES, the phase voltages applied to motor can be varied. The appropriate selection of PES is important to achieve optimized system performance.

Block Diagram of PML DC Motor Control



- **Signal processing unit:** Heart of the system, consists of sub-system where control software is run. It also includes the PWM drive and sensing circuits.
- **The power switch circuit:** Controls the flow of power to motor terminals. It also includes the inverter for conversion of DC voltage to AC voltage applied to motor terminals.
 - Six power switching devices.
 - Depending on type of motor control, either two phases or three phases are ON at any instant.
- **Position signal:** Use of mechanical sensor for position or speed. provide the rotor position information, necessary for the ON/OFF control of the power switches in an inverter.
 - Sensorless operation is also possible, where the rotor position and speed can be derived using software processing the motor current and voltage signals.

Type of Power Electronic Switches

Power Electronic Switch	Bipolar Transistor (BJT)	Metal–Oxide–Semiconductor Field-Effect Transistor (MOSFET)	Insulated-Gate Bipolar Transistor (IGBT)	Intelligent Power Module (IPM)
Symbol				
Control Method	Current	Voltage	Voltage	Voltage
Need for Gate Drive	No	Yes	Yes	No
Voltage Rating*	500V	1200V	3000V	1200V
Current Rating*	100A	500A	600A	100A
Max. Switching Frequency*	20 kHz	1MHz	50 kHz	20 kHz
Switching Loss	High	Low	Low	Medium
On-state Voltage Drop	Low	High	Low	Low
Protection	None	None	None	Yes
Cost	Low	Low	Medium	High

* Typical values

- MOSFET's are predominantly used to control PML DC motors for automotive accessory and home appliances due to high speed and low switching losses.
- For Traction motor inverter, IGBT's are used due to high voltage and current capability.