

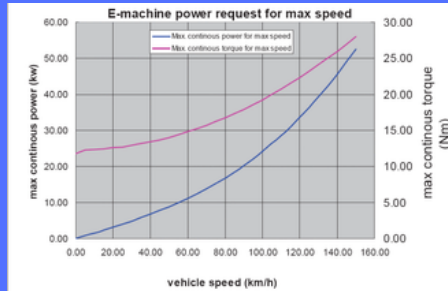
Motor Drive System Design for Electric Vehicles

1 Identify requirements

EV motor needs

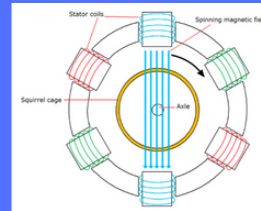
- Starting, acceleration, climbing
- Wide speed range; high torque across speed range

Power vs speed

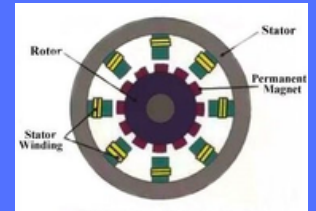


2 Select motor type

Induction (IM)

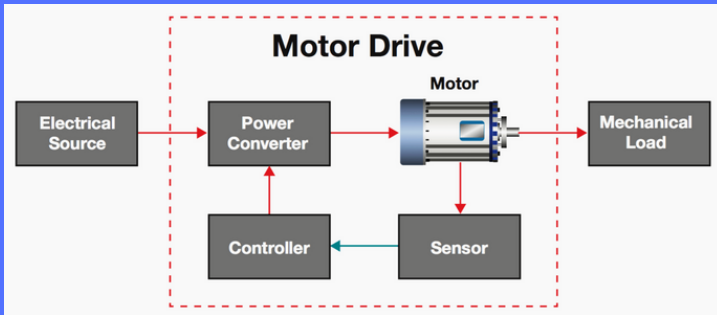


Permanent Magnet Synchronous (PMSM)



3 Drive design (PMSM)

Basic Idea



PMSMs have...

- higher efficiency
- power density
- less noise
- controllability



but are also more expensive

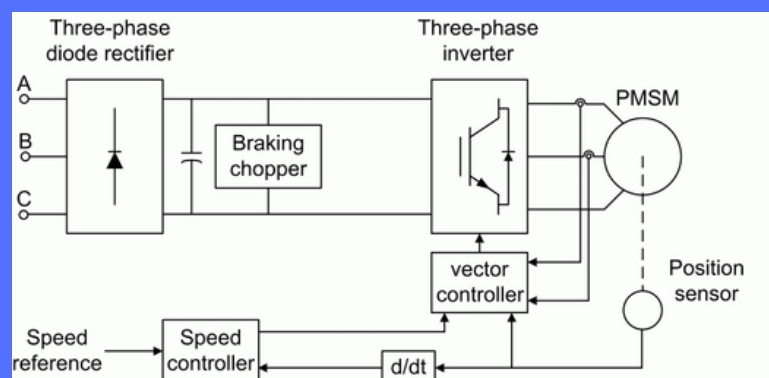


4 Recent and Future developments

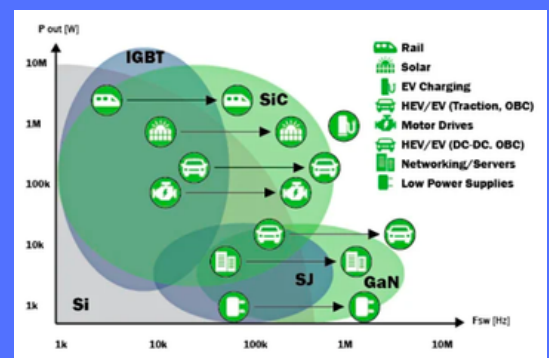
- Better permanent magnets
- Hybrid motors combining features of PMSM, IM, and SRMs
- Wide-band-gap semiconductors (GaN and SiC) to improve efficiency of power electronics

Vector/Field Oriented Control (FOC) enables

- smooth operation over entire speed range
- full torque at zero speed
- high dynamic performance



Simplified vector control block diagram



Industry shifts to SiC and GaN