Power Screws and Bolted Connections

ME4020 - Applied Machine Design

Mechanical Engineering

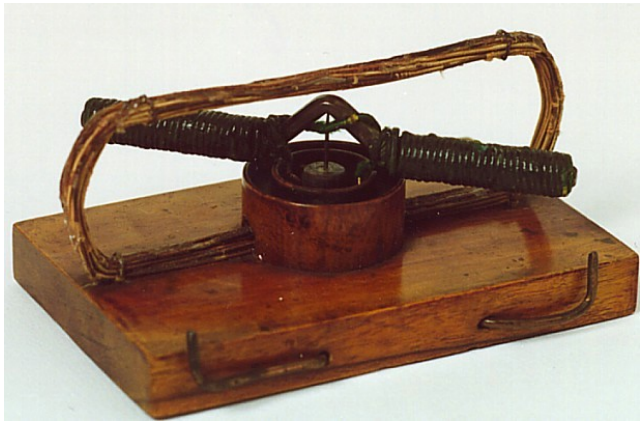
Tennessee Technological University

Motor Selection

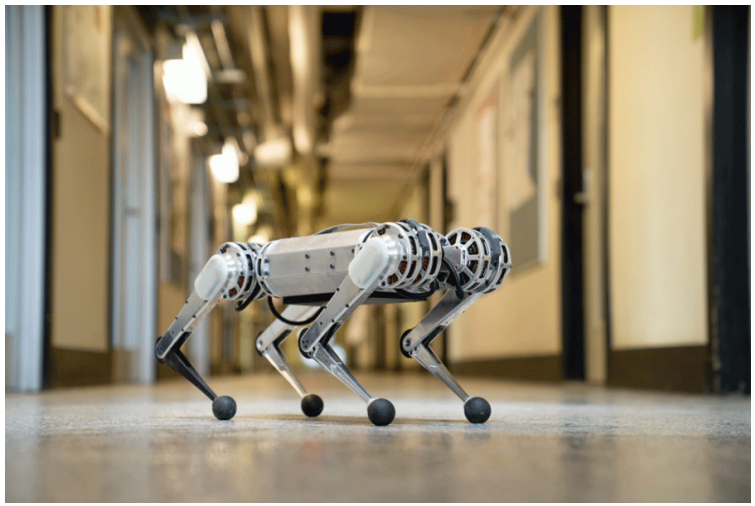
Motor Selection

- Classification of Electric Motors
- Open Loop and Closed Loop Control
- Motor Torque-Speed Curves
- Motor Driver/Controller
- Analysis and Selection

Classification of Electric Motors

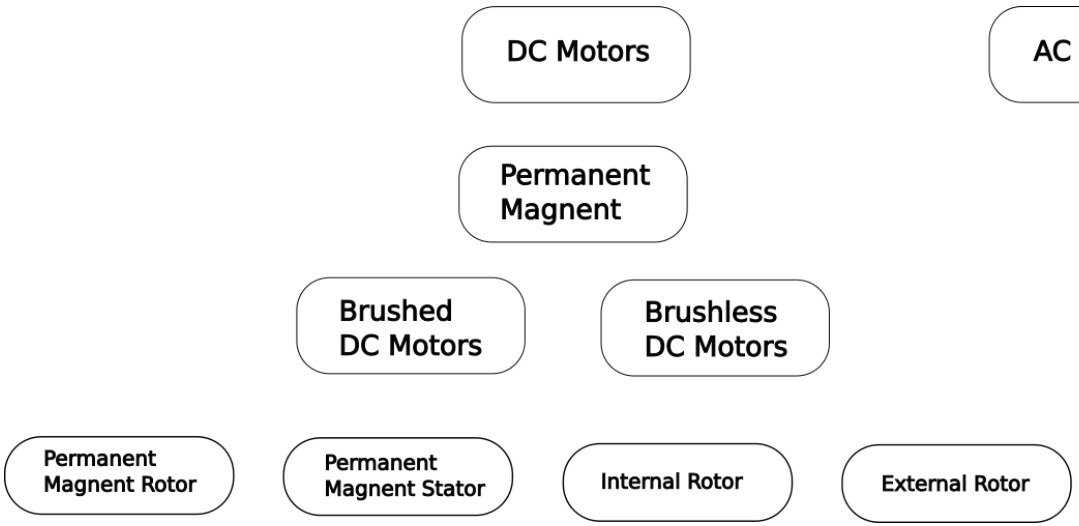


Jedlik's Electromagnetic Self-Rotor



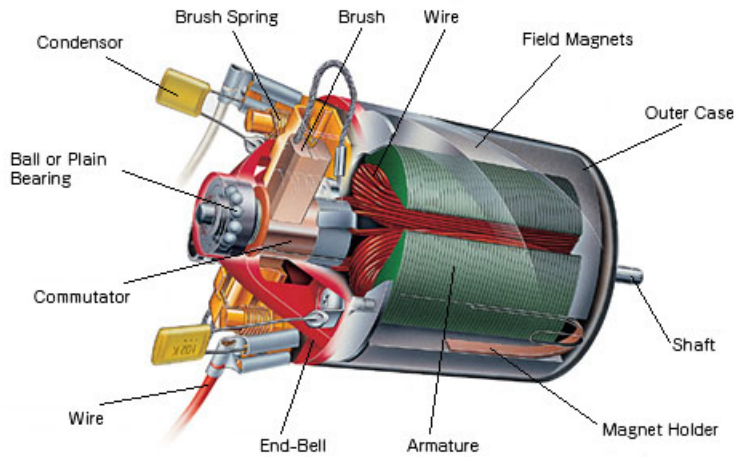
MIT Mini Cheetah

Classification of Electric Motors



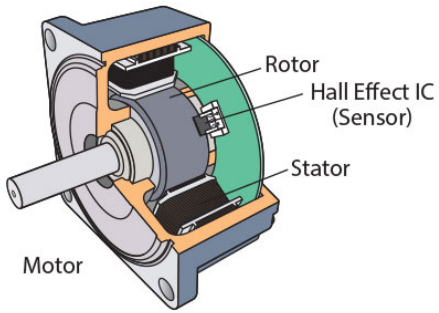
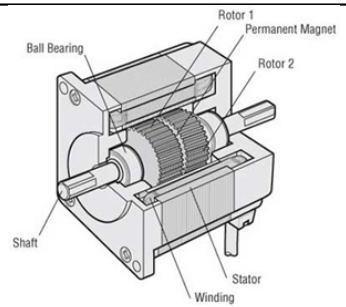
Classification of Electric Motors

Common Electric Motor Types

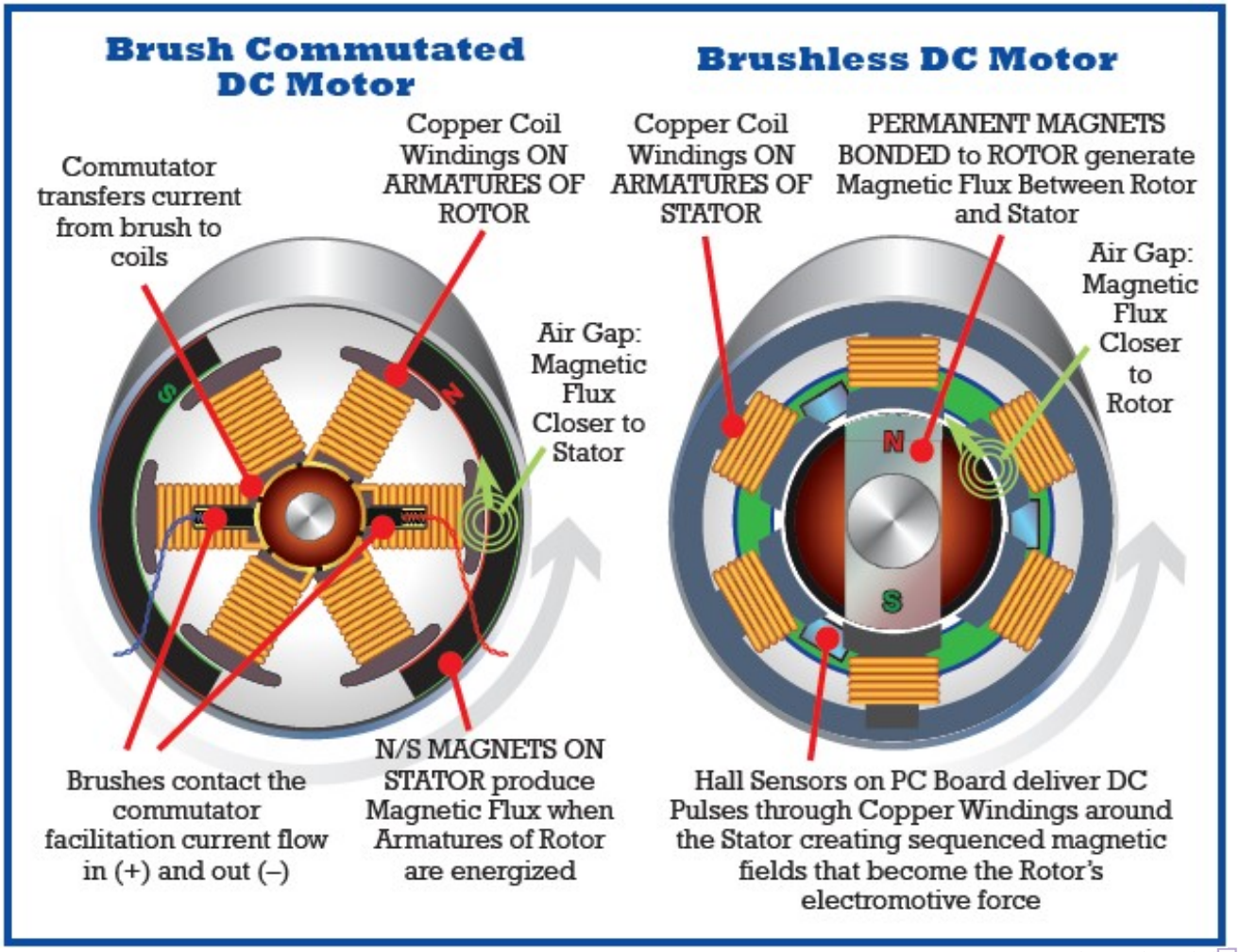
— Type —	— Example —	— Application —
		
		

Classification of Electric Motors

Common Electric Motor Types

— Type —	— Example —	— Applications —
		
	 Motor Structural Diagram: Cross-Section Parallel to Shaft	

Classification of Electric Motors



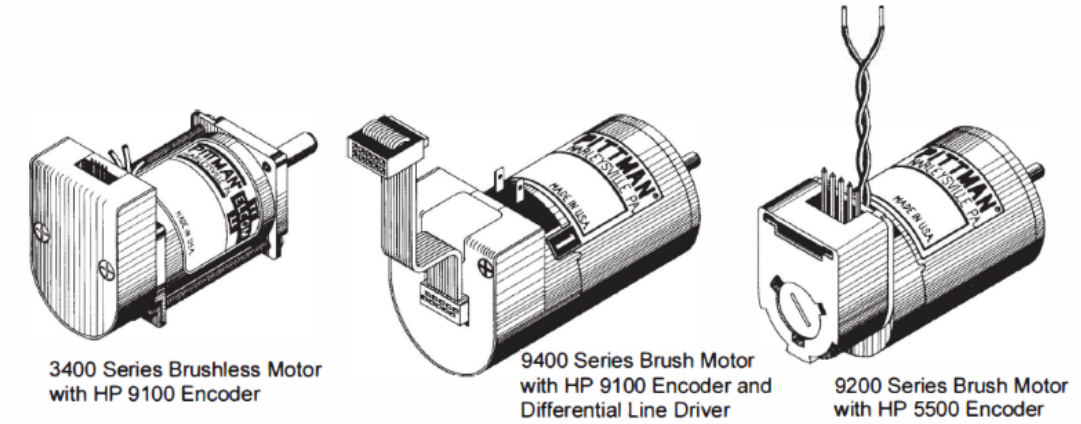
Open Loop and Closed Loop Control

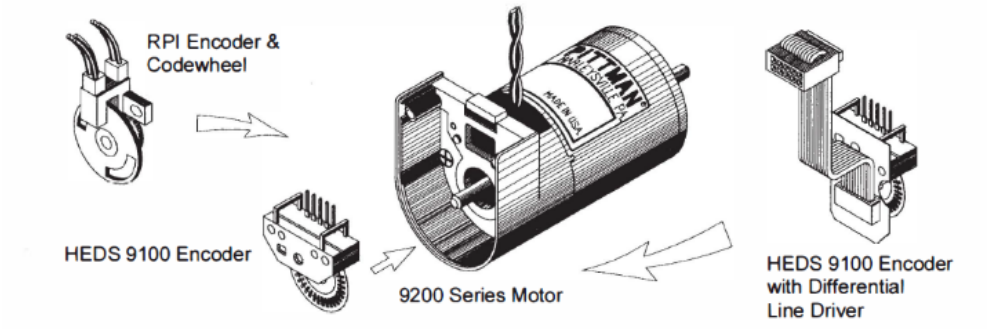
Open Loop vs Closed Loop Control

- Open Loop Control
- Bang-Bang Control
- Armature Control
- Position Control
- Velocity Control

Open Loop and Closed Loop Control

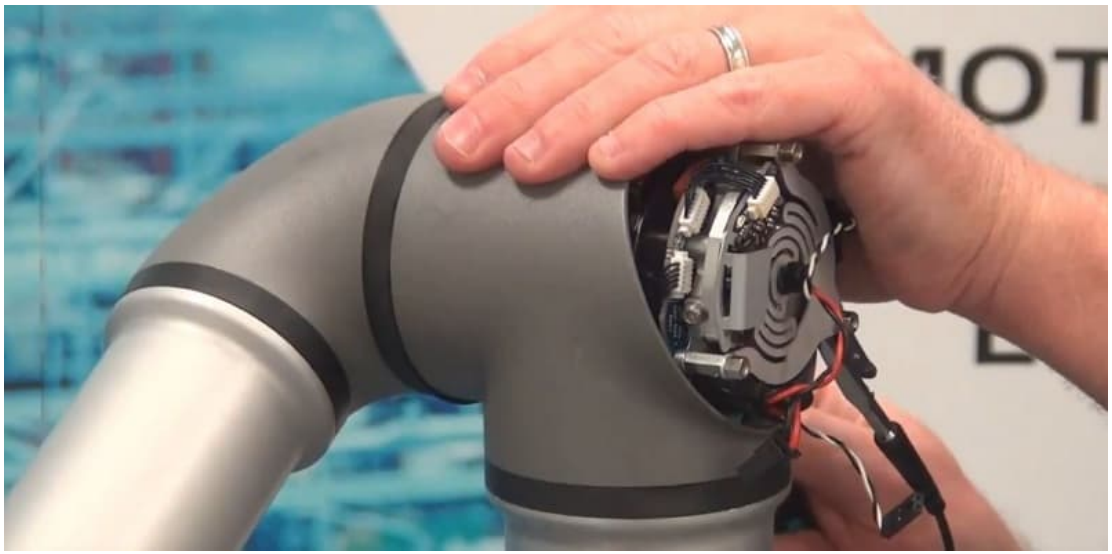
Feedback Controlled Brushed DC Electric Motor





Open Loop and Closed Loop Control

Feedback Controlled Brushless DC Electric Motor
Modern Case Study: Universl Robotics - Arm Joint



Open Loop and Closed Loop Control

Applications:

-
-
-

Pros

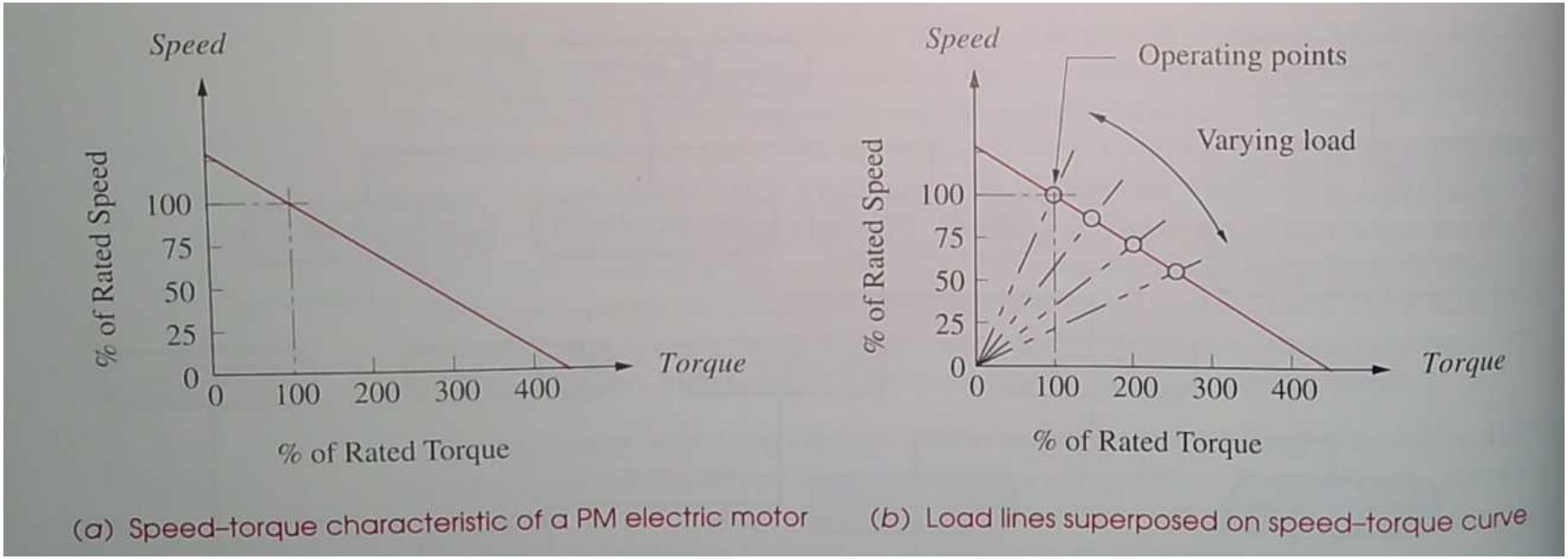
-
-
-

Cons

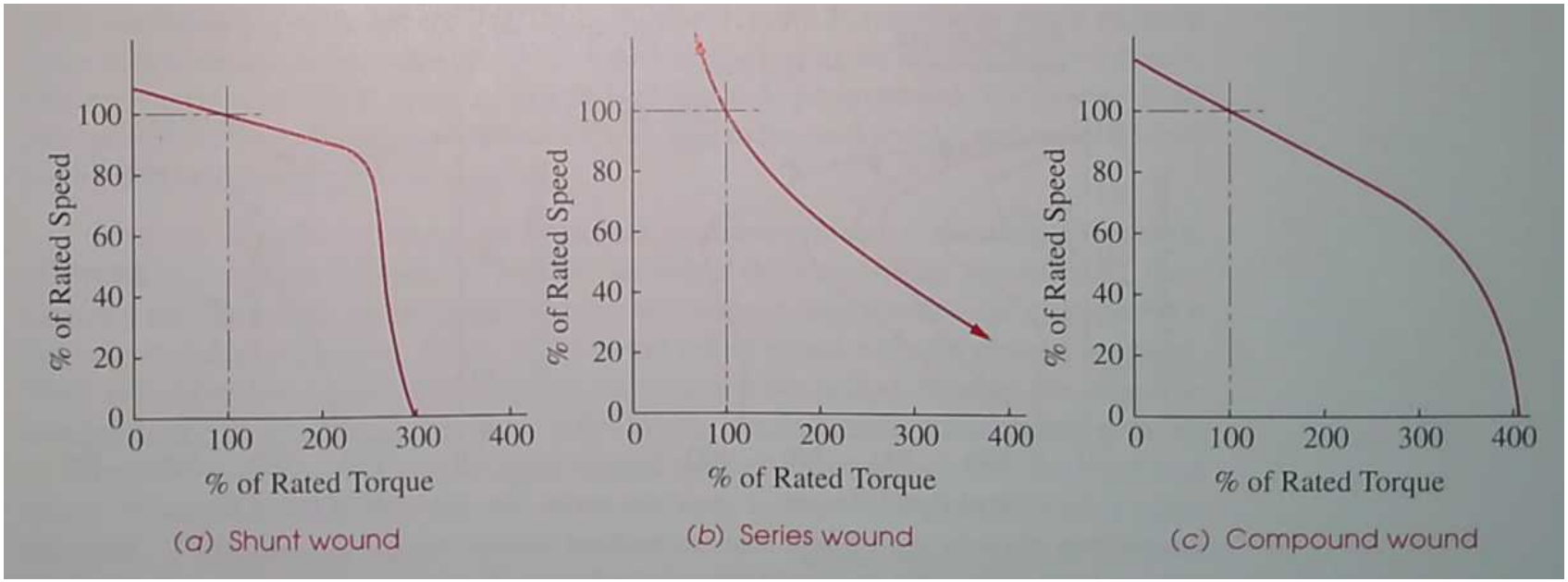
-
-
-

Open Loop and Closed Loop Control

Motor Torque-Speed Curves



Motor Torque-Speed Curves



Motor Torque-Speed Curves

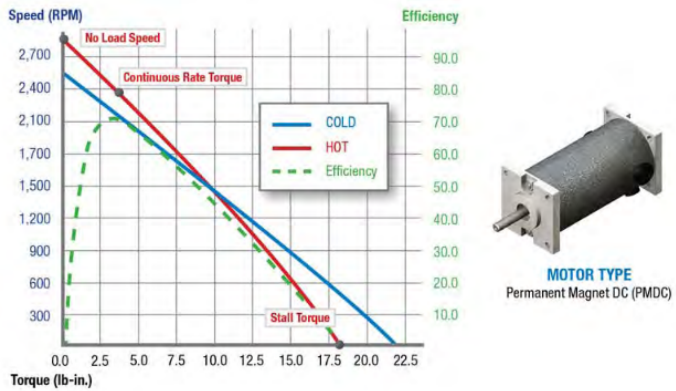


Figure 7: *Speed, Torque, Efficiency Curves of a PMDC motor*

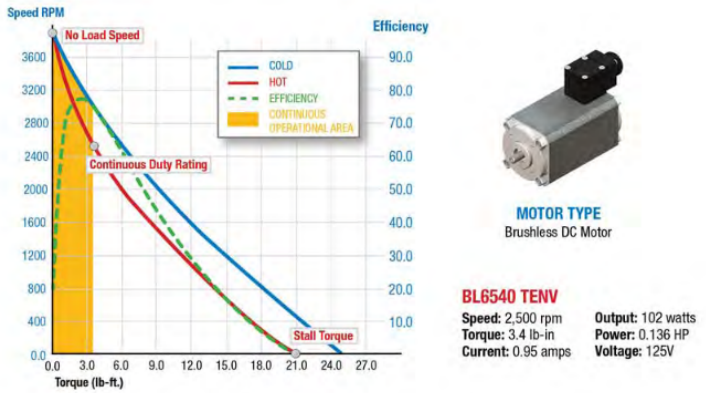


Figure 10: *Speed, Torque, Efficiency Curves of a BLDC motor*

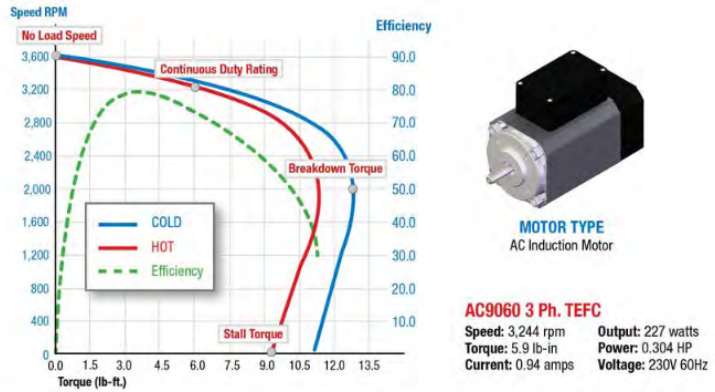


Figure 9: Speed, Torque & Efficiency Curves of an AC Induction Motor

Motor Driver/Controller

A motor driver, aka controller, is required to operate an electric motor.

- low-level -> high-level, high-end
- open-loop, close-loop
- various signal inputs (e.g. analog, PWM, Serial, USB, etc)
- dip switches + potenionmeter configured -
- computer configuration and user interace
- feedback control integration

Analysis and Selection

Considerations for Motor Selection:

- What are the torque requirements?
- What are the speed requirements?
- Does the application require a feedback control?
- What type of motor driver or controller is required?
- Does the form factor of the motor fit in the machine?

Analysis and Selection

Haydon Kerk Pittman Ametek - Brushed DC
Haydon Kerk Pittman Ametek - Brushless DC