

Power Screws and Bolted Connections

ME4020 - Applied Machine Design

Mechanical Engineering

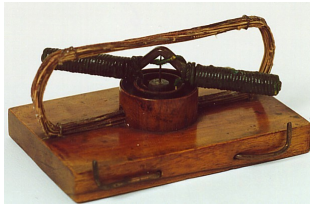
Tennessee Technological University

Motor Selection

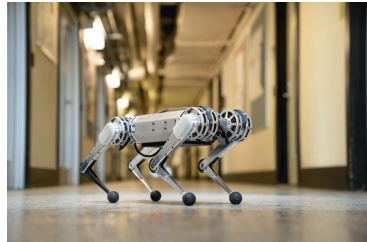
Motor Selection

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

Classification of Electric Motors

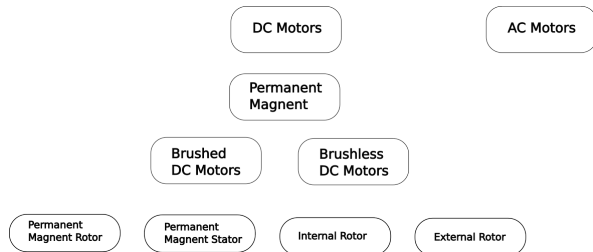


Jedlik's Electromagnetic Self-Rotor




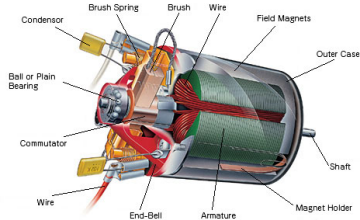
MIT Mini Cheetah

Classification of Electric Motors



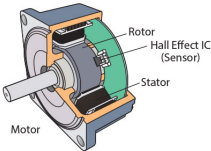
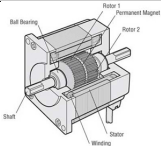
Classification of Electric Motors

Common Electric Motor Types

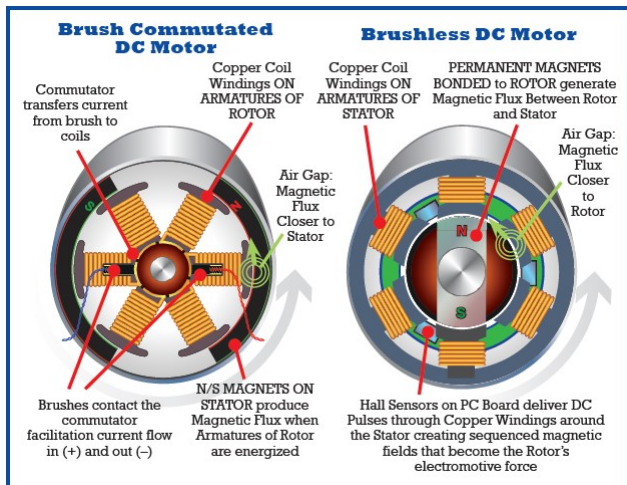
| — Type — | — Example — | — Application — |
|----------|---|-----------------|
| |  | |
| |  <p>Labels in diagram: Condensor, Brush Spring, Brush, Wire, Field Magnets, Outer Case, Ball or Plain Bearing, Commutator, End-Bell, Armature, Magnet Holder, Shaft.</p> | |

Classification of Electric Motors

Common Electric Motor Types

| — Type — | — Example — | — Applications — |
|----------|---|------------------|
| |  | |
| |  | |

Classification of Electric Motors



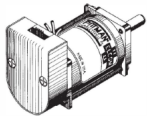
Open Loop and Closed Loop Control

Open Loop vs Closed Loop Control

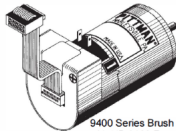
- Open Loop Control
- Bang-Bang Control
- Armature Control
- Position Control
- Velocity Control

Open Loop and Closed Loop Control

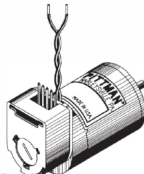
Feedback Controlled Brushed DC Electric Motor



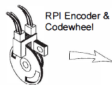
3400 Series Brushless Motor
with HP 9100 Encoder



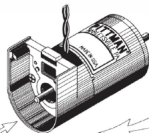
9400 Series Brush Motor
with HP 9100 Encoder and
Differential Line Driver



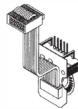
9200 Series Brush Motor
with HP 5500 Encoder



HEDS 9100 Encoder



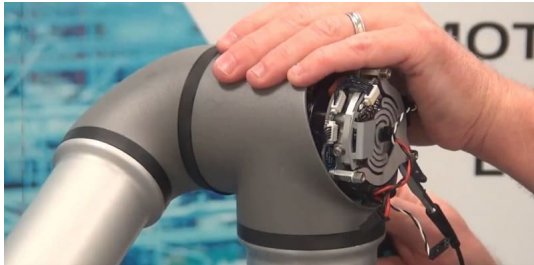
9200 Series Motor



HEDS 9100 Encoder
with Differential
Line Driver

Open Loop and Closed Loop Control

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



Open Loop and Closed Loop Control

Applications:

-
-
-

Pros

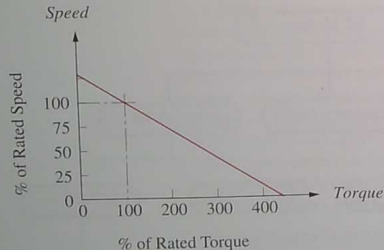
-
-
-

Cons

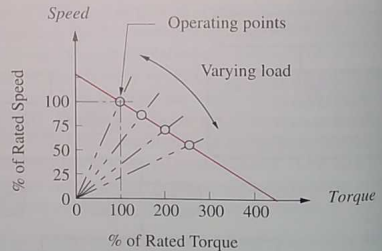
-
-
-

Open Loop and Closed Loop Control

Motor Torque-Speed Curves

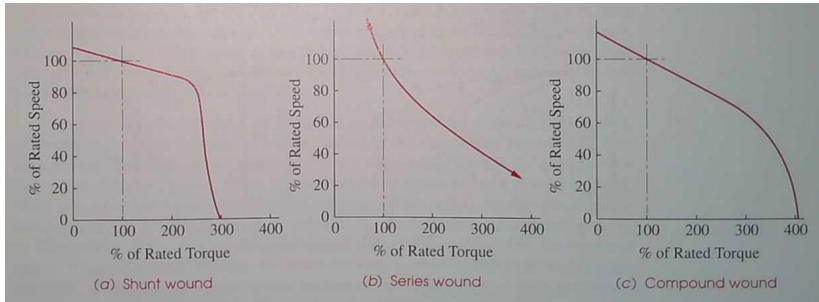


(a) Speed-torque characteristic of a PM electric motor



(b) Load lines superposed on speed-torque curve

Motor Torque-Speed Curves



Analysis and Selection

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