EN2533 – Robot Design and Competition
Homework 7

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Motor Type	Brushed DC Motor	Brush-less DC Motor	Stepper Motor	Servo Motor
Torque	Low but can increase with a reduction gear set	Depends on the current given by the controller	Low	High
Speed	Moderate	High	Low	High
Phases	1	2/3	Multiple phases	Single
Commutation	Mechanical	Not mechanical.Electromagnetic	No need for position feedback or communication	Not mechanical. Electromagnetic with an encoder
Rotor	Consist of brush and shaft	Permanent magnet	2 cups and permanent magnet	Brush and shaft
Stator	Coils are evenly wound around iron cores	Made from laminated steel stacked up carry the windings	Consist of poles with teeth or an iron disk	Consist of cylindrical frame with magnets inside
Terminals	2	2	4 or 5	3
Magnetic Field Generation	Field magnet	Permanent magnet	Teetheed permanent magnet	Field magnet
Angular Resolution	Low	High	High	Moderate
Motor Complexity	Simple	Complex	Complex	Complex
Control Mechanism	Voltage controlled	Sensor or less control	Stepper controller	Closed loop feedback
Control Complexity	Low	High	High	Moderate
Use of H Bridges	Direction, speed control	Direction, speed control	Depend on the polarity	N/A
Driving Modes	NA	NA	Full, half, micro step	NA
Cost	Low	High	High	Moderate
Advantages	Low cost, Easy to handle	High torque and speed, Less noise	High torque in low speeds, Safer	High accuracy,Quiet
Disadvantages	Not precise, Brushes should be changed	High cost, Complex operation	Low efficiency, accuracy, No feedback	Complex controller, Requires tuning
Commercially Available Product	C23,C34 by Moog Components	Micro BLDC by Telco, NEMA BLDC	NEMA 17 bipolar,NEMA 23 CNC Stepper	SDLM-051-095-01-01,TowerPro SG90,Futaba S3003

1 References

Components by Moog
DC motors by ElectroCraft
Nema 17 Bipolar Stepper Motor
Nema 23 CNC Stepper Motor
Example - 1 for servo motor
Example - 2 for servo motor