

As you can see, the total inertia with the higher gear reduction ratio is practically the same as the rotor inertia of the motor. The maximum angular accelerations will be:

$$(a) \ddot{\theta}_m = \frac{T_m}{I_{total}} = \frac{8}{0.098} = 82 \text{ rad/sec}^2$$

$$(b) \ddot{\theta}_m = \frac{T_m}{I_{total}} = \frac{8}{0.0158} = 506 \text{ rad/sec}^2$$

The no-load maximum angular acceleration of the motor would be about 530 rad/sec².

7.3 Comparison of Actuating Systems

Table 7.1 is a summary of actuator characteristics. We will refer to, and discuss, these characteristics throughout this chapter.

DC motors, stepper motors, servomotors
 3 magnets, 4 coils

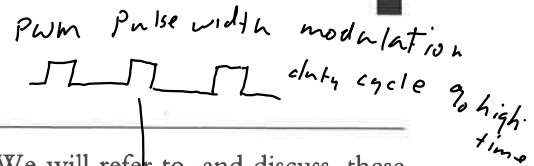


Table 7.1 Summary of Actuator Characteristics.

Hydraulic	Electric	Pneumatic
<ul style="list-style-type: none"> + Good for large robots and heavy payload + Highest power/weight ratio + <u>Stiff</u> system, high accuracy, better response + No reduction gear needed + Can work in wide range of speeds without difficulty + Can be left in position without any damage - May leak; not fit for clean room applications - Requires pump, reservoir, motor, hoses, and so on - Can be expensive and noisy; requires maintenance - Viscosity of oil changes with temperature - Very susceptible to dirt and other foreign material in oil - <u>Low compliance</u> - High torque, high pressure, large inertia on the actuator 	<ul style="list-style-type: none"> + Good for all sizes of robots + Better control, good for high precision robots + Higher <u>compliance</u> than hydraulics + Reduction gears reduce inertia on the motor + Does not leak, good for clean room + Reliable, low maintenance + Can be spark-free; good for explosive environments - <u>Low stiffness</u> - Needs reduction gears, increased backlash, cost, weight, and so on - Motor needs braking device when not powered; otherwise, the arm will fall 	<ul style="list-style-type: none"> + Many components are usually off-the-shelf + Reliable components + No leaks or sparks + Inexpensive and simple + Low pressure compared to hydraulics + Good for on-off applications and for pick and place + <u>Compliant</u> systems - Noisy - Require pressurized air, filter, and so on - Difficult to control their linear position - Deform under load constantly - Very low stiffness; inaccurate response - Lowest power to weight ratio

good for "bang-bang" control

air