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

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

The no-load maximum angular acceleration of the motor would be about 530 rad/sec^2. ■

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.

Table 7.1 *Summary of Actuator Characteristics.*

Hydraulic	Electric	Pneumatic
+ Good for large robots and heavy payload	+ Good for all sizes of robots	+ Many components are usually off-the-shelf
+ Highest power/weight ratio	+ Better control, good for high precision robots	+ Reliable components
+ Stiff system, high accuracy, better response	+ Higher compliance than hydraulics	+ No leaks or sparks
+ No reduction gear needed	+ Reduction gears reduce inertia on the motor	+ Inexpensive and simple
+ Can work in wide range of speeds without difficulty	+ Does not leak, good for clean room	+ Low pressure compared to hydraulics
+ Can be left in position without any damage	+ Reliable, low maintenance	+ Good for on-off applications and for pick and place
– May leak; not fit for clean room applications	+ Can be spark-free; good for explosive environments	+ Compliant systems
– Requires pump, reservoir, motor, hoses, and so on	– Low stiffness	– Noisy
– Can be expensive and noisy; requires maintenance	– Needs reduction gears, increased backlash, cost, weight, and so on	– Require pressurized air, filter, and so on
– Viscosity of oil changes with temperature	– Motor needs braking device when not powered; otherwise, the arm will fall	– Difficult to control their linear position
– Very susceptible to dirt and other foreign material in oil		– Deform under load constantly
– Low compliance		– Very low stiffness; inaccurate response
– High torque, high pressure, large inertia on the actuator		– Lowest power to weight ratio