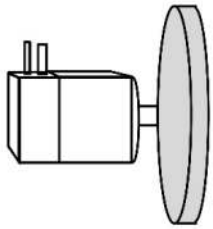
Inertia ratio

As we saw in the speed and force sections, there is more than one way to achieve a certain load speed or a certain load applied force. So how do we proceed with choosing the right approach for our needs?

Inertia ratios:
another very important factor for machine performance is the inertia ratio between the motor inertia and the load(s) inertia.

Let's consider this next example:

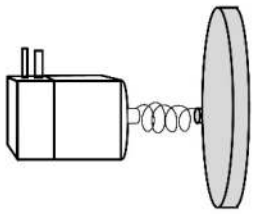


A motor shaft is welded to a steel wheel.
the motor's rotor mass is $1/50^{th}$ of the mass of the steel wheel. But since they are welded together the motor is applying all its force to move the combined masses.

In this case we can calculate the maximum possible acceleration of the wheel:
a =t/I

a -> angular acceleration [radians/s^2]
t ->torque [Nm]
I ->moment of inertia [kg*m^2]

now let's consider this example:



the same motor connected to the same wheel , this time through a torsion spring.
In this scenario we can accelerate the motor much faster than the previous scenario. But only until the spring is fully stretched. And all that while the load will accelerate moderately. So the load is very late to react and the system performance is very bad.

The connection between motor and load is called coupling. as we can see the coupling rigidity is highly important for the system's performance.