Back Emf

Generated Voltage

Back Emf is the voltage generated by the coil in the actuator like a generator does. When you move the actuator by hand, you generate a voltage over the coil.

This voltage is also generated if it moves due to current through the coil. In this case it is in the opposite direction of the current which you apply to make the coil move.

Example: You apply 24V to an actuator with a Back Emf of 10V/m/sec . What would be the maximum achievable speed?

Solution: If you move so fast that the 24V is spend to compensate the Back Emf , you have reached the speed at which you cannot accelerate anymore. So 24/10 = 2.4 m/sec is the maximum speed. Note that the PWM bridge of the controller consumes a small voltage. The realistic speed will therefore be lower.

Theoretical Value

The Back Emf can be calculated from the properties of the actuator:

Back Emf Voltage = B * n * speed , Back Emf Constant = B * n

(With B being the magnetic field flux and n being the number of windings)

If you compare this with the Force Constant formula:

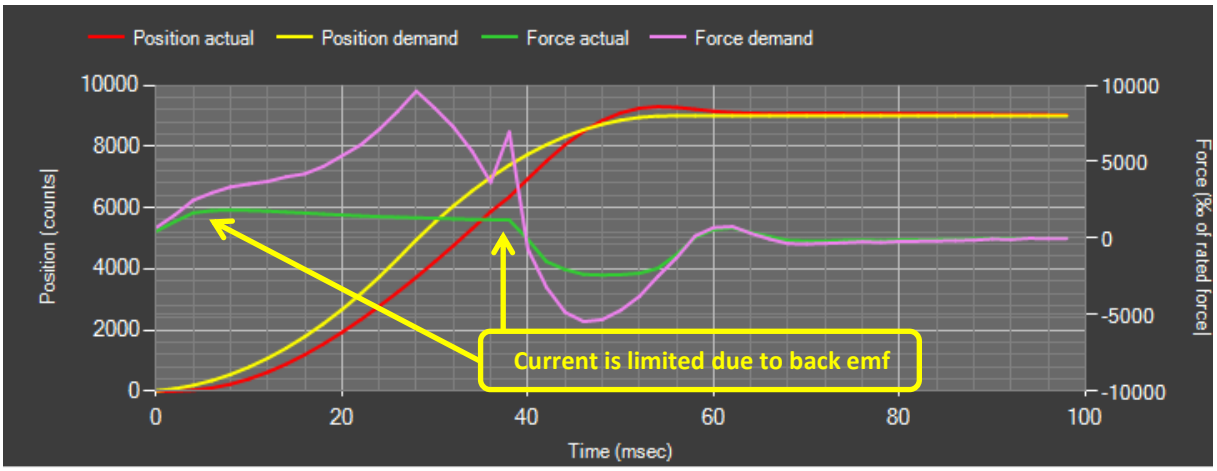
Force = B * I * n , , Force Constant = B * n

(With I being the current through the coil)

It shows that both Force Constant and Back Emf Constant are based upon the same actuator parameters and have the same value. The Force Constant is expressed in N/A and the Back Emf Constant is expressed in V/m/sec.

Practical Consequences

This means that as soon as the maximum speed is reached the actuator is not capable of moving any faster. If the target velocity is higher than this the actual current will not increase where the demanded current will increase. This can be seen in the image below.



The back emf voltage that has been building up during acceleration is released to be added to the power supply voltage at deceleration. If your power supply does not have any capacity to take that energy the voltage of the supply will increase. If the voltage gets too high the controller can be damaged. Therefore it is wise if you use a 48V supply voltage in combination with a high back emf unit (=high force constant) that has a stroke length that enables higher speeds, to add an additional capacitor to the power supply of approximately 6800 µF / 63V.