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When calculating the PWM Equivalent Voltage, we generally assume that the motor will operate ideally and respond as if it was connected to a non-PWM power source providing the voltage. But that"s not the case. For example, a Yellow-TT motor will easily spin if a single 1.5-volt battery is connected, but will not turn until the PWM Equivalent Voltage coming from a Motor FeatherWing reaches 2.0 volts when operating in fast decay mode. And when it does start, it suddenly rotates at 4000 RPM. Why is that?

Since a brushed DC motor"s internal rotor consists of two or more coils of wire wound around laminated magnetic core material, the motor acts like an inductor. Depending on size of the rotor coil, it may take a few milliseconds for the energy to build sufficiently to turn the shaft.

Rotor coil inductance becomes an important factor to consider when using PWM for motor speed control. The motor coil works best when the applied voltage is relatively steady since it needs time for its magnetic field to reach the needed strength. At higher PWM frequencies, the pulses from the motor controller board change too quickly to provide enough energy to spin the motor until the equivalent voltage reaches 2.0 volts, although switching to using slow decay mode can help.

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