6 Pulse Width Modulation.

The simplest way to control the speed of an electric motor would be to vary the voltage between zero and the maximum voltage. Unfortunately this doesn't work. First of all, the motor needs a minimum voltage to get started, so it will immediately go from off to fast. Secondly, the torque at low speeds is extremely low. The solution is to keep the voltage constant at the maximum, which eliminates starting problems, and simply switch the power on and off. If you do that quickly enough the motor will run very smoothly, even at low revolutions.

Pulse Width Modulation uses pules at maximum voltage that vary in length depending on the required amount of power.

PWM is an acronym for Pulse Width Modulation. This means pulses will be used at full power. The number of these pulses per second is constant, but the duration (width) of the pulses is varied (modulated). The wider the pulses the more power they contain. And thus the more power is sent to the device. The next Figure shows how PWM works.

In the top graph the width of the pulses is 10% of the period, the time between the start of two consecutive pulses. This is called the duty cycle, and is the part of the period where power is actually delivered. In the middle graph the duty cycle is 50%. The bottom graph shows 100%. The latter, of course, means that the power is always on and the motor runs at full speed.

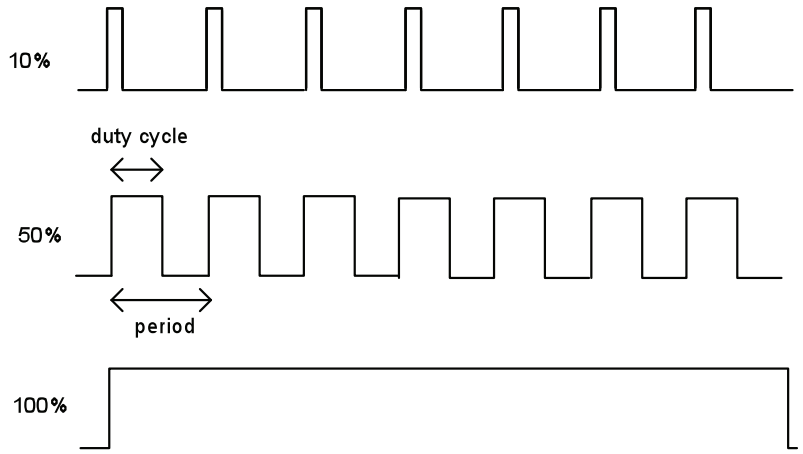

Figure 185. PWM duty cycles.

The larger the duty cycle the higher the average power that PWM delivers. Of course this technique can be used for many other applications other than motors. For example dimming lights as we will see in the first project in this chapter.