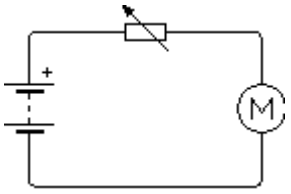
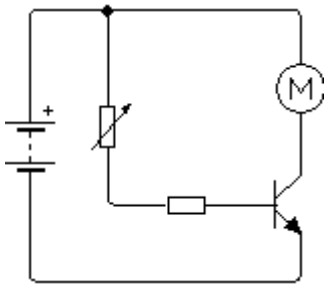
Controlling the speed of a motor

The two circuits to the right show how the speed of a motor can be controlled. The first circuit uses a rheostat to limit the motor's current. This method is inefficient since a significant amount of power will be dissipated by the rheostat. This method will also reduce the torque of the motor.



Rheostat used to control motor's speed

The second circuit uses a transistor to limit the current through the motor. Although this circuit is more efficient than the first, the current flowing though the transistor will cause it to become hot (thus wasting power.) This heat must be dissipated by using a large heatsink. This circuit is particularly limited when high power motors are used as this necessitates the use of an expensive high power transistor. This method also reduces the torque of the motor.

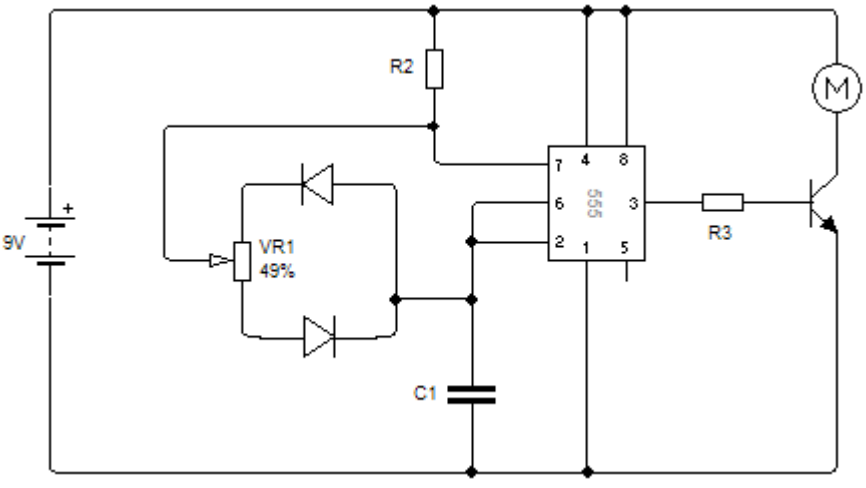


Transistor used to control motor's speed

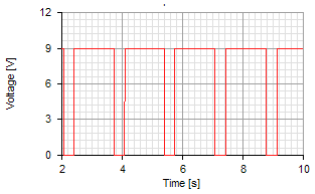
Controlling the speed of a motor using Pulse Wide Modulation (PWM)

An astable circuit can be used to construct a Pulse Width Modulator. This circuit generates pulses of power of varying length depending on the position of the variable resistor. By controlling the duration of the pulses the motor speed is adjusted: the longer the pulses the faster the motor will run. Because the transistor is switched either fully on or fully off it increases its efficiency. This system can be used with high power motors and the torque will only be limited by a smaller degree. In the circuit shown below the NPN transistor can be replaced with a MOSFET when used to drive higher power motors, the transistors must be fitted with a heatsink to prevent damage.

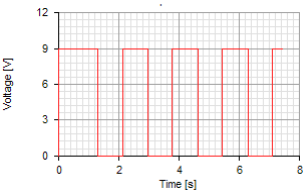
The graphs shown on the right show the pulses of current flowing through the motor at various speeds.



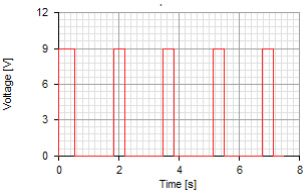
PWM motor speed control circuit



Motor running at 95% of maximum speed



Motor running at 50% of maximum speed



Motor running at 5% of maximum speed

E.Clarvis 2009