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## Motor speed control

Many small projects involve the use of hobby or toy motors, such as those sold by Radio Shack in their 273 series. These small motors work off low-voltage dc, typically three to

six volts. Although they do draw relatively large current when under load, most will work off a small battery pack. Because of this, they are very popular for motorizing scale models and mobile displays.

The major disadvantage of these motors is their speed—usually around 10,000 rpm. One way to lower the speed is to use an appropriate gear box. But even then, you'll still have only one speed. You can get some speed control with a rheostat in series with the motor, but at low speeds, the motors tend to stall. Here's a circuit that overcomes this problem, giving you smooth speed control of most hobby motors.

The circuit uses a 4011 CMOS NAND gate, a pair of diodes and an NPN power transistor to provide a variable duty-cycle dc source. Adjusting the speed control varies the average voltage applied to the motor.

The peak voltage, however, is not changed.

This *pulse* power is effective at very low speeds, constantly kicking the motor along. At higher speeds, the motor behaves in a nearly normal manner.

The circuit can be built on any convenient material. Perfboard is ideal. Although a 2N3055 transistor is specified in the diagram, any NPN transistor with a collector current rating greater than the motor drain can be used. Since the transistor is working as a switch, turning on and off for time periods set by the speed control, it shouldn't require a heat sink. However, you can sink it if you wish.

The capacitor value isn't critical, and any value from .01 to .05 mfd will work well. You may find, however, that for the particular motor you have, one value will work better than others.

