Square Wave Generators

This is a square wave generator circuit. The main component of this circuit is the 741, a general-purpose operational amplifier. This circuit employs a single power supply Vs that can range from +5V to +15V.

The square wave output of this circuit is easy to adjust. 'Timing' is defined by C1, R4, R5, R6, and R7 while duration is defined by R1, R2, and R3. Pulse symmetry is achieved by making the resistance from pin 3 to ground equal to the resistance from pin 3 to Vs. If this is desired, then R1, R2, and R3 may simply be replaced by two equal resistors from pin 3, one of which is tied to Vs while the other is tied to ground.

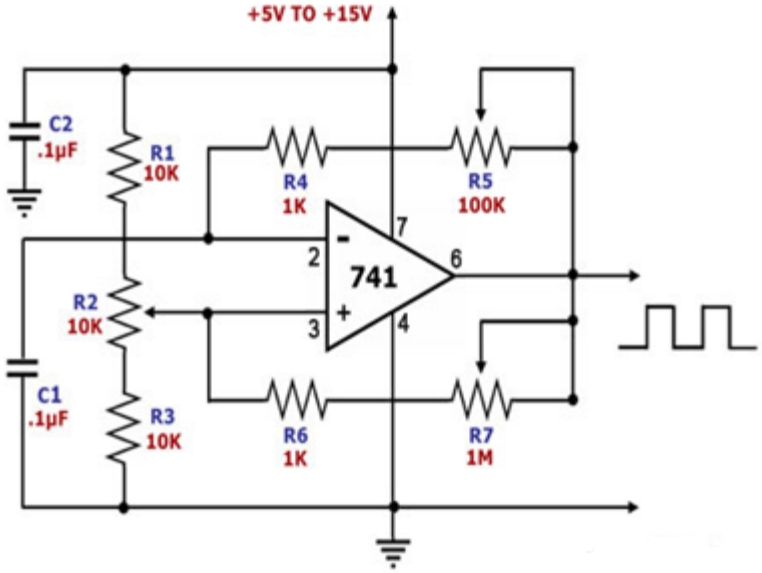

Figure 2.9

The circuit to the right uses a comparator with both positive and negative feedback to control its output voltage. Because the negative feedback path uses a capacitor while the positive feedback path does not, however, there is a time delay before the comparator is triggered to change state. As a result, the circuit oscillates, or keeps changing state back and forth at a predictable rate.

Because no effort is made to limit the output voltage, it will switch from one extreme to the other. If we assume it starts at -10 volts, then the voltage at the "+" input will be set by R_2 and R_1 to a fixed voltage equal to $-10R_1/(R_1 + R_2)$ volts. This then becomes the reference voltage for the comparator, and the output will remain unchanged until the "-" input becomes more negative than this value. But the "-" input is connected to a capacitor (C) which is gradually charging in a negative direction through resistor R_f. Since C is charging towards -10 volts, but the reference voltage at the "+" input is necessarily smaller than the -10 volt limit, eventually the capacitor will charge to a voltage that exceeds the reference voltage. When that happens, the circuit will immediately change state. The output will become +10 volts and the reference voltage will abruptly become positive rather than negative. Now the capacitor will charge towards +10 volts, and the other half of the cycle will take place.