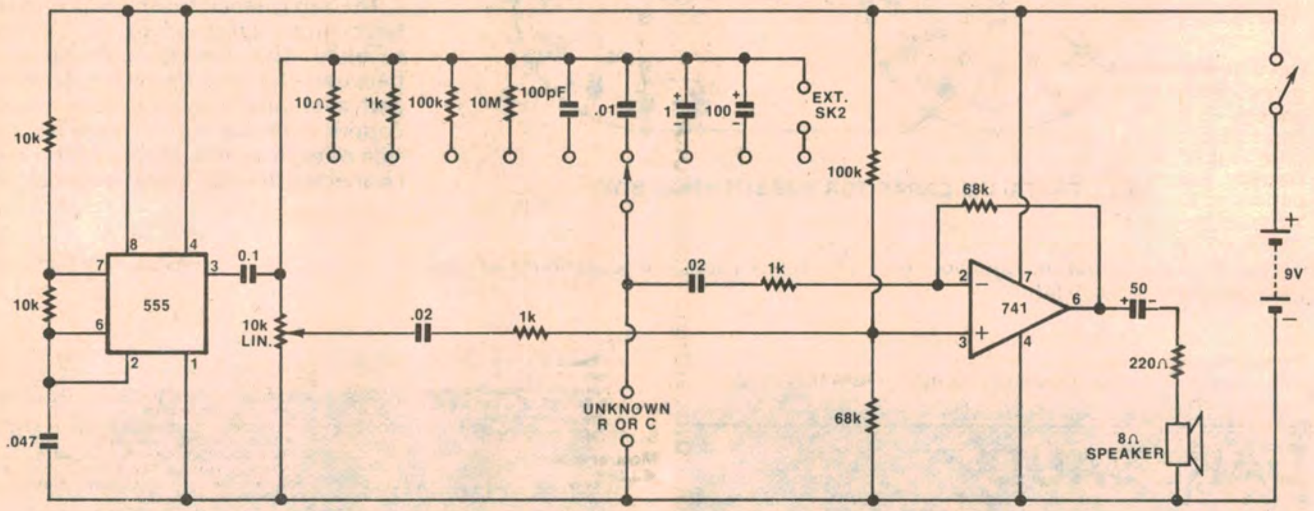
CIRCUIT & DESIGN IDEAS

Interesting circuit ideas and design notes selected from technical literature, reader contributions and staff jottings. As they have not necessarily been tested in our laboratory, responsibility cannot be accepted. Contributions to this section are always welcome, and will be paid for if used.

Conducted by Ian Pogson

Bridge measures unknown resistance and capacitance



This bridge may be used to determine, with reasonable accuracy, the value of resistors and capacitors over a very wide range. The bridge is formed by two arms of the 10k potentiometer, the unknown and the reference value as chosen by the switch. The 555 serves as an oscillator in the audio range and the 10k potentiometer is adjusted for a minimum output from the headphones or loudspeaker, as determined by the 741 difference amplifier.

The 10k potentiometer should be calibrated by determining significant points obtained by using resistors or capacitors of known value and accuracy. The external reference socket may be used as a means for testing coils or for different ranges other than those which the switch offers.

(By Mr D. Brighton, Franklin Road, Huonville, Tasmania 7109.)

Improved resistance-capacitance oscillator

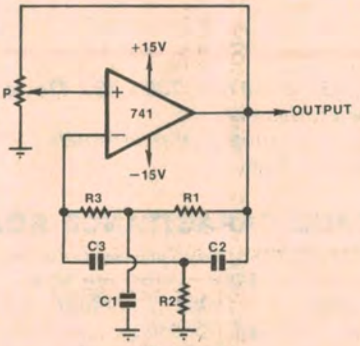


FIG. 1

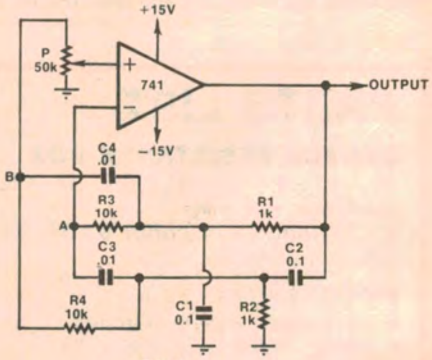


FIG. 2

In a common form of RC oscillator as show in figure 1, a parallel-T network in a negative feedback loop nulls at one frequency, allowing positive feedback via the potentiometer to sustain oscillation at that frequency. The frequency stability is worse and the harmonic distortion is higher than that of a resonant (inductance/capacitance) oscillator because the bandwidth of an RC network is greater than the bandwidth of an LC circuit.

Unfortunately, inductors are usually large and expensive but a suitably proportioned parallel-T network can, with the addition of an extra resistor and capacitor, produce two outputs, one at point A (figure 2), a voltage which nulls at one frequency and the second at point B, a voltage which peaks, and is in phase with the network input voltage, at the same frequency. Positive feedback can now be taken from point B, giving a measure of frequency discrimination to the positive feedback loop and narrowing the overall oscillator bandwidth.

A comparison of measurements made on the two circuits shows the improvement to be expected. Standard tolerance resistors and capacitors were used. Better results can be obtained by using matched components, or by using trimpots for R3 and R4. Both circuits were adjusted to give an output voltage of 4.5V P-P.

The frequency stability for a 10% supply voltage change was 0.17% for figure 1 and .011% for figure 2. Harmonic distortion was measured at 2.2% and 0.55%, respectively.

The choice of frequency, 1591.5Hz, may seem unusual but has been deliberately chosen as part of an impedance meter, to simplify calculations of inductive and capacitive reactance. Provided the parameters given below are observed, an oscillator of any frequency may be made.

$R1 = R2 = Xc1 = Xc2$

$R3 = R4 = Xc3 = Xc4 = k1R1$, where k is equal to or greater than 10

$P = k2R3$, where k2 is equal to or greater than 5

X is the reactance at the frequency of oscillation, fo.

(By Mr R. Salter, 12 Ayr Street, Macleod, Victoria 3085.)