ideas for design

Voltage-controlled music oscillator has linear control properties

A voltage-controlled oscillator for electronic music applications has a linear frequency-vs-control-voltage characteristic that passes through the origin (Fig. 1). The control-voltage range is standardized over 0 to 5 V.

For the circuit in Fig. 2, the frequency of the 8038 oscillator IC is given by

$$f = (1.5/RC)\,[1/(V_{cc} - V_{ss})]\,(V_2 - V_1).$$

The 741 op amp is biased so that its output, V_1, equals V_2 when V_c is zero. The bias is set with resistor R_3.

Since the op-amp output is unable to reach the value of V_{cc}, the value of V_2 is obtained by a reduction of about 1.4 V from V_{cc} to 13.6 V with two silicon-diode voltage drops. The minimum value of V_1, which corresponds to the maximum control voltage—and thus the maximum output frequency—is specified for the 8038 to be no less than two-thirds of the total supply voltage. Two-thirds of the supply voltage of 30 V is 20 V. Thus V_1 minimum is +5 V above ground, since the low end of the supply is −15 V. This value of V_1 should correspond to the maximum $V_c = 8$ V to allow 60% overrange capability (Fig. 2). Therefore the full frequency-vs-voltage scale is set to 5 V by adjustment of the ratio

$$R_2/R_1 = [V_2 - V_1\,(\text{min})]/V_c\,(\text{max})$$
$$= (13.6 - 5)/8 = 1.075.$$

If you choose $R_1 = 82$ kΩ and $R_2 = 91$ kΩ and substitute the values for the supply voltages, you get

$$f = (0.055/RC)\,V_c.$$

The best linearity is obtained when R lies between 10 kΩ and 100 kΩ. For the values in Fig. 2, f = 6 kHz for $V_c = 5$ V. The supply voltages should be well-regulated to minimize the drift of the zero frequency point. This point must correspond to zero control volts to preserve the harmonic relationships in a musical scale. The circuit can be easily modified, by proper choice of R_3, to provide frequency modulation about a nonzero center frequency.

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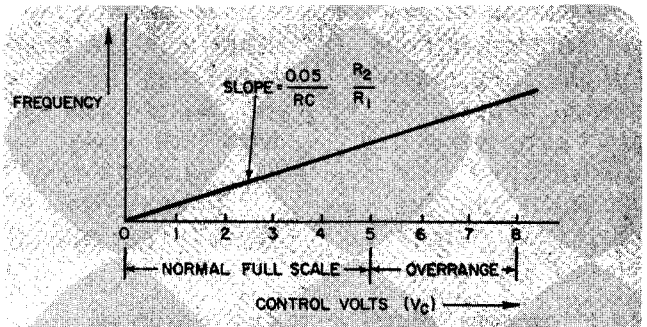
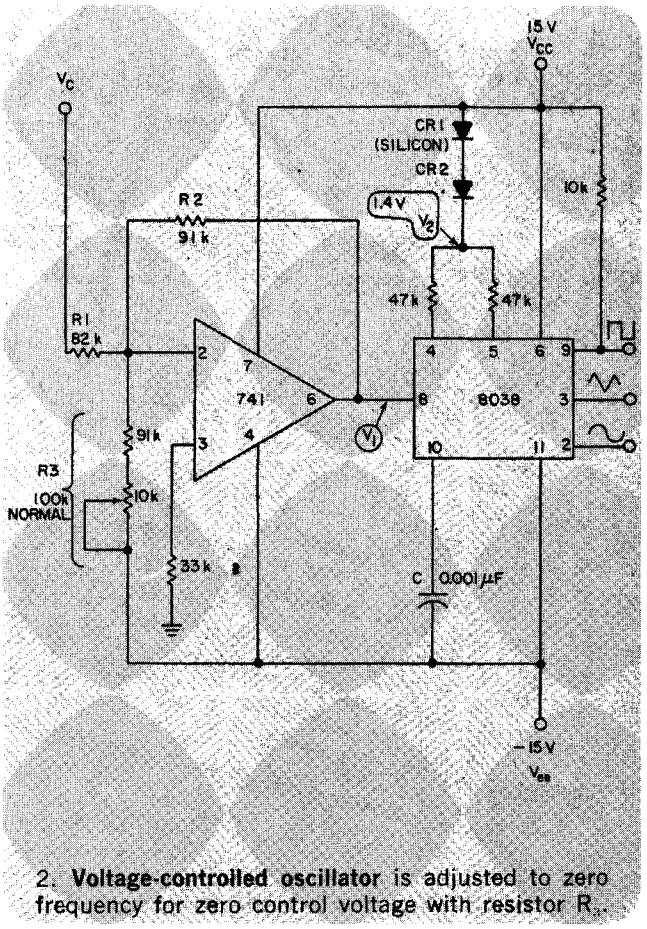


1. **The frequency-vs-control-voltage characteristic** for electronic music applications should be a slope that is proportional to the control voltage and that passes through the origin.



2. **Voltage-controlled oscillator** is adjusted to zero frequency for zero control voltage with resistor R_3.