

Fig. 7.8a. Circuit of a simple function generator

BIASED DIODE NETWORK

The next step is to see how biased diode networks are used to achieve an increase of resistance with applied voltage, and thus imitate the behaviour of an ideal voltage dependent resistor. Unfortunately, currently available silicon carbide, selenium, and copper oxide resistors are far from ideal in many respects, and are not sufficiently accurate for serious use with operational amplifiers.

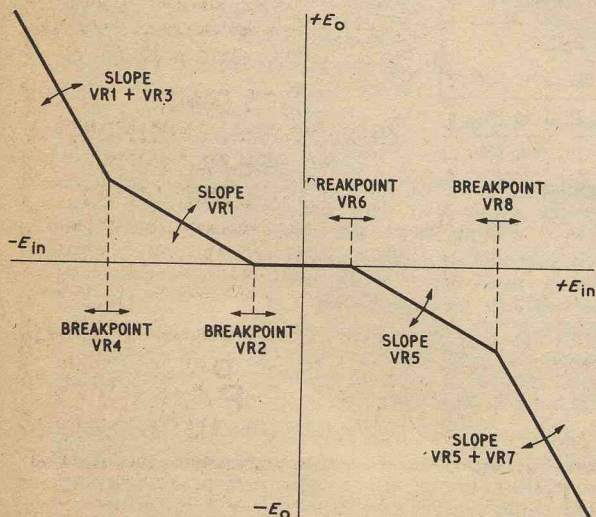
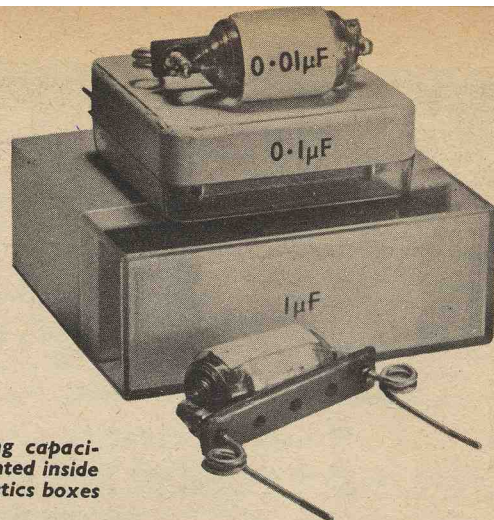


Fig. 7.8b. Adjustable characteristic of simple function generator



Computing capacitors mounted inside small plastics boxes

The UNIT "C" function generator is based on the simple circuit of Fig. 7.8a. In the absence of an input voltage all diodes are biased off, and the network can be represented by a very high value of resistance in series with the operational amplifier input, giving an amplifier gain of almost zero. If a positive voltage is gradually applied to the input terminal, there will be virtually no output until a point is reached where E_{in} is slightly larger than $-E_b$, whereupon D1 conducts and connects VR1 to the operational amplifier summing junction. Further increase of E_{in} , beyond $-E_b$, will produce a straight line output of slope determined by the amplifier gain $R_f/VR1$.

When E_{in} reaches approximately the level of $-E_{b2}$, D2 conducts and places VR3 in parallel with VR1, thus reducing even more the effective resistance of the network. It can be easily imagined that where a number of diodes and variable resistances are cascaded, the resistance of the network will continue to fall as E_{in} becomes larger still.

Bias voltage $-E_b$ is determined by the relative resistances of VR1 and VR2, and the same applies to $-E_{b2}$, VR3 and VR4. Furthermore, the setting of VR1 will obviously affect the combined slope of VR1 and VR3 (see Fig. 7.8b), and it follows that all the resistance settings associated with D1 and D2 must be interrelated.

Considerations applying to the positive branch of circuit Fig. 7.8a are also pertinent to the negative branch formed by D3 and D4, and VR5-VR8, except that input and bias voltage polarities are reversed. There is no interaction between the resistance settings of the positive branch and the negative branch, and the two can be separated when required for independent use.

The output characteristic curve of Fig. 7.8b identifies slopes and breakpoints with VR1-VR8. As there are only two diodes in each branch, the result is a very rough approximation to a smooth curve. Generally speaking, the accuracy of a diode function generator is proportional to the number of diodes employed, but a natural rounding at the junction of straight lines does occur at low input voltage levels, due to the dynamic resistance of the diodes (not shown in Fig. 7.8b), so the deviation from a smooth curve is not as great as might be expected. Commercial diode function generators sometimes use more than 20 diodes to achieve accuracies of better than 1 per cent.

Next month: Construction of UNIT "C" and some practical applications of this Function Generator.