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Research Paper

Study of RC Phase Shift Oscillator using variable capacitance

Physics

KEYWORDS:

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ABSTRACT

This paper describes a type of resistance-capacitance-tuned phase shift oscillator. A three- or more mesh phase-shifting network is connected between the output and input of an amplifier. When the gain of the amplifier is adjusted to maintain oscillation, almost pure sine-wave output is obtained. Variations in the basic circuit have been analyzed.

Introduction:

A phase shift oscillator is a linear electronic oscillator circuit that produces a since wave output. It consists of an inverting amplifier element such as a transistor with its output fed back to its input through a phase – shift network consisting of resistors and capacitors in a ladder network. The feedback network 'shifts' the phase of the amplifier output by 180 degrees at the oscillation frequency to give positive feedback. Phase shift oscillators are often used at audio frequency as audio oscillators.

Method:

A sine wave operation may be obtained from an oscillator using an RC network in the place of the Inductance network. The R.C. network is positioned between the output and input circuit, which in the Common Emitter arrangement means between Oscillator and Phase. Furthermore, since the output signal is 180° out of phase with the input signal. The R.C. Coupling network must introduce an additional 180° phase shift to sustain oscillations.

In order to achieve this, three identical RC sections are generally employed , each shifting the signal by 60°. Each section consists of a series coupling capacitor and a shunt resistor. In the figure 1, these are R1 and C1, R2 and C2 and R3 and C3. The Phase shift comes about because R and C in series produce a current which leads the applied voltage by a certain angle. This angle is determined by the numerical relationship of Resistance and Capacitance. The smaller the Capacitance, the more the Current will lead the voltage for a given resistance. By properly selecting R and C, 60° phase shift per section can be achieved. Note that the shift will occur at only one frequency. If, however, either R or C is made variable, Frequency can be obtained by $F = 1/4.88\pi RC$.

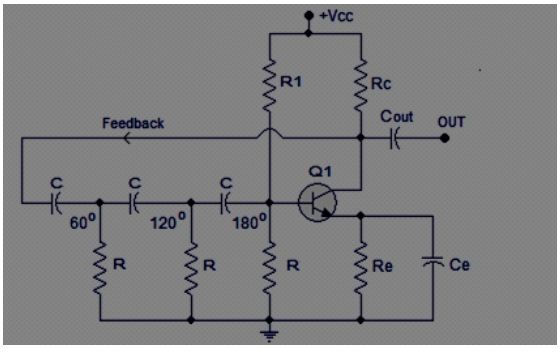

Figure 1: Circuit diagram of RC phase shift oscillators

Table 1: Observations table for RC phase shift oscillator for variable capacitance

Sr No	R (ohm)	C (micro farad)	Calculated Frequency Hz	Time Period T ms	Observed Frequency Hz
1	10 K	0.033	196.99	4.8	208.33
2	10 K	0.1	65.01	13.0	76.923
3	10 K	0.015	433.38	2.2	454.55
4	10 K	0.068	45.55	8.0	125

Results obtained are shown in Table 1. These are shown for variying capacitances. Calculated and Observed frequencies are compared. They found to be in agreement with each other.