

## A Three Phase Function Generator in Power Systems

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### ABS TRACT:

A variable frequency and variable phase function generator with three outputs of (1) 2, is described in this paper. The1 and (3) lag phase  $f_0$  - reference  $f_0$  (2) lead phase  $f_0 + 1$  is continuously adjustable over 0 to 180 leading phase difference by an input control 2 is also continuously adjustable over 0 to voltage VC1 and the lagging phase difference 180o by an another input control voltage VC2, independent of frequency of operation of the function generator which can be set by a third control input dc voltage  $-V_I$ .

### Introduction:

Using function generators with phase-shifted and referenced outputs is crucial for designing and testing contemporary control and instrumentation circuits. One such is the phase-sensitive detector [1], which is crucial for measuring power, impedance, instrument transformer error, and other things. A sine wave generator and an extra phase shifter are a common tool for testing phase-sensitive detectors and phase-measuring circuits. Using this technique, the phase difference  $\theta$  between the two outputs is obtained using an all-pass filter.. When the values of R and C vary because of their tolerances, the phase difference is altered along with the sine wave's frequency, and  $\theta$  is also affected. By using an astable multivibrator and a divide by three logic network, followed by a divide by two logic network with a synchronization gate, [2] created a variable frequency fixed phase sequence. Variable phase sequence cannot be obtained with this method. By using

a technique described by [3], millimeter wave signals with phase shifts ranging from 0 to 360 degrees can only be created at a constant frequency. A perfectly adjustable phase difference between the outputs that is unaffected by drift in component values and operating frequency would be very advantageous. Only dual phase applications can benefit from a variable frequency and variable phase function generator with dual outputs [4]. This study describes an enhancement on circuit [4] as a three-phase function generator for three-phase applications.

### Circuit Analysis:

The circuit diagram of the proposed three phase function generator is shown in Fig. 1 and its associated waveforms in Fig. 2. A saw tooth wave with peak value  $V_R$  is generated by op amps OA1,OA2 and a switch SW1. Let us assume that at start, the charge and hence voltage at the output terminal of op amp OA1 is zero. Since the inverting terminal of the opamp OA1 is at virtual ground, the current through R, namely  $V_I / R$  amps, would flow through



2722 universal counter. The readings were taken. It is observed from the readings that the (1) Frequency Error in the range 10Hz - 100Hz = 0.5%, 100Hz - 1KHz = 1% and 1KHz - 10KHz = 2% (2) Phase error in all frequency ranges is found to be less than 0.1%.

### References

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