Introduction to Oscillators

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Introduction

Oscillators are signal sources. They have an output and no input. All oscillators are positive feedback systems. There are a wide variety of oscillator circuits to produce sine waves, triangle waves, square waves, ramp waves, and others. There are two basic methods for signal generation based either on s-plane methods (linear for sine wave generation) or comparator driven analog state machine methods (non-linear for triangle, square, etc.).

Sine Wave Oscillators

Methods involving the s-plane are used to generate sine waves. It should be remembered from s-plane analysis that a pair of quadratic poles exactly on the jw axis result in a steady state sine wave. If the poles are in the left s-plane then the oscillation damps to zero. If the poles are in the right s-plane then the oscillation grows exponentially until some limit is reached. The sine wave oscillator circuit is a classic control system with just the right amount of positive feedback to cause the system poles to be just in the right s-plane and either limiting or amplitude control stabilizes the level.

State Machine Methods

One or more comparators are used often in conjunction with an RS flip-flop to form two states – one controlling the rising portion of a waveform and the other controlling the falling portion of a waveform. Charge is added to and then subtracted from a capacitor using either a resistance driven by a switched voltage source or using a switched constant current source causing the voltage across the capacitor to rise or fall. The comparator(s) switch at specific voltages across the capacitor thus changing the state of the circuit.