Precision Full-wave Rectifier without Loading Effect

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Abstract

This paper presents an OPA-based precision full-wave rectifier without loading effect. The circuit consists of two operational amplifiers, two diodes and few passive elements. This circuit is used few elements, and is capable of giving amplified output and has high input impedance and low output impedance. HSPICE simulation and the experiment results are in good agreement with the theoretical analysis.

Keywords: full-wave rectifier, operational amplifier

1. INTRODUCTION

If the output and the input waveforms are not related by a linear equation, the circuit is said to be operating in a nonlinear fashion. A precision rectifier is one of important nonlinear circuits extensively used in analog signal processing systems. When a diode is used in half- and full-wave rectifiers, its nonlinear characteristics tend to distort the output waveform at low signal levels. Since a silicon diode must be forward biased to about 0.7 V before condition begins, device is not suitable for the rectification of small signal levels below several volts. The use of operational amplifiers (OPAs) can improve the performance of the voltage drop that occurs in an ordinary semiconductor rectifier and give precision rectification [1-4].

A precision full-wave rectifier circuit is also known as an absolute value circuit. This means the circuit gives an output signal in proportion to the magnitude of its input signal, regardless of the input polarity [5]. Fig. 1 shows that the output equals the absolute value of the input.

There are three conventional OPA-based precision full-wave rectifier circuits in Fig. 2, Fig. 3 and Fig. 4.

Fig. 2 is composed of a precision half-wave rectifier followed by a two-input summing amplifier. This circuit performs general well at low frequencies but products moderate to severe waveform distortion at frequencies above 1 kHz [6].