Regular paper

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PII: S1434-8411(17)30158-9
DOI: http://dx.doi.org/10.1016/j.aeue.2017.05.039
Reference: AEUE 51910

To appear in: *International Journal of Electronics and Communications*

Received Date: 21 January 2017
Accepted Date: 24 May 2017

Please cite this article as: H-P. Chen, Y-S. Hwang, Y-T. Ku, A systematic realization of third-order quadrature oscillator with controllable amplitude, *International Journal of Electronics and Communications* (2017), doi: http://dx.doi.org/10.1016/j.aeue.2017.05.039

A systematic realization of third-order quadrature oscillator with controllable amplitude

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Abstract:

A systematic realization of third-order quadrature oscillator using a voltage-mode non-inverting lowpass filter and a voltage-mode inverting lossless feedback integrator is presented in this paper. The proposed circuit consists of two multiple-output differential voltage current conveyor transconductance amplifiers (MO-DVCCTAs), two grounded resistors and three grounded capacitors. The new circuit provides three quadrature voltage outputs, two high-impedance quadrature current outputs, and one high-impedance current output with controllable amplitude, simultaneously. When the input bias current of the first MO-DVCCTA is a modulating signal, the circuit can generate amplitude modulation or amplitude shift keying signals. The condition of oscillation and the frequency of oscillation can be controlled independently through grounded resistors. The proposed circuit only uses grounded capacitors and grounded resistors, which can be easily implemented as an integrated circuit. The experimental results and H-Spice simulation results are given to confirm the theoretical analysis.

Keywords: Sinusoidal oscillator, voltage-mode, current-mode, modulating signal, current conveyor

1. Introduction

Sinusoidal oscillators are crucial circuit blocks for the communication, instrumentation, and measurement systems. For example, they can be employed in a quadrature mixer and a single-sideband modulator of telecommunications [1]. In communication systems, a sinusoidal oscillator can generate the amplitude-controllable sinusoidal signal, which can be used to apply the carrier signal for amplitude modulation (AM) signal and amplitude shift keying (ASK) signal systems [2]. High-performance electronic tunable active components get more attention, because the traditional electronic components may have deviations in fine-tuning the tolerances of the electronic components [3–19]. These circuits are used to design voltage-mode second-order filters and second-order quadrature oscillators. Except all the above second-order quadrature oscillators, several third-order quadrature oscillators have been proposed [20–33]. The third-order oscillators