A New Quadrature Sinusoidal Oscillator for Telecommunication System Using VDDDAs

***Abstract*— A CMOS voltage differencing differential difference amplifiers (VDDDAs) based voltage-mode quadrature sinusoidal oscillator is proposed. The proposed oscillator is based on the two integrator loop configuration with amplifier wherein the frequency of oscillation (FO) is tuned by the time constant of two integrator and the condition of oscillation (CO) is tuned by gain of amplifier. It is constructed from two VDDDAs, two resistors, and two grounded capacitors. With this structure, it is attractive to develop in monolithic chip. The tuning of frequency of oscillation can be electronically done without affecting the condition of oscillation. Also, the condition of oscillation can be adjusted by external resistor without affecting to frequency of oscillation. The simulation results have been demonstrated and discussed using parameters of 0.18um TSMC CMOS technology and ±0.9V power supply voltages.**

Keywords*— VDDDA; sinusoidal signal; voltag-mode; CMOS; quadrature oscillator

I. INTRODUCTION

In telecommunication system, the sinusoidal signal is very important. It is required as carrier signal in modulation and de-modulation system. The circuit which generates sinusoidal signal is well known as oscillator. There are many kinds of sinusoidal oscillator such as phase shift, wein bridge, quadrature, hartley and colpitts oscillator etc. The quadrature oscillator which generates two sinusoidal signals with 90 degree phase difference is also used in various applications such as communication system, instrumentation, measurement and signal processing, etc. [1]. Especially in telecommunication systems, the quadrature sinusoidal oscillator is frequently used to generate the carrier signal for FM, QAM etc. [2]

"Using of active building block for circuit design is very popular in use. It gives the flexibility for designer to realize the high performance circuit using minimum number of active element [3-6]. With mentioned features, the principle of active building blocks for both current and voltage mode circuit are introduced by Biolek et al. [6]. VDDDA [7] is one of the interests. It allows interesting utilization and design of more profitable or more exacting application especially the electronic controllability." [8] From our survey it is found that the electronic circuit using VDDDA as active elements have been reported, for instance the voltage-mode first order all pass filter [7], oscillator [7], [9], universal filter [8-12], inductance simulator [13].

In this paper, the voltage-mode quadrature sinusoidal oscillator is proposed. Two CMOS VDDDAs are used as active building block with two resistors and two grounded capacitors. It is suitable for fabricating as a monolithic chip. The proposed oscillator has the advantage of independent control of frequency of oscillation and condition of oscillation. Also, the frequency of oscillation can be electronically tuned by adjusting the bias current. PSpice simulations are included to confirm the theoretical analysis.

The paper is organized as follows. Section II.A describes the basic concept of voltage differencing differential difference amplifier. In Section II.B, the block diagram for design the quadrature oscillator is presented. Section II.C, the proposed quadrature oscillator is analyzed and described and Section III shows simulation results.

II. CICUIT DESIGN

A. Description of Used Active Building Block

"The characteristic of the main active building block will be described. It is named as voltage differencing differential difference amplifier (VDDDA). This device is formed by operational transconductance amplifier (OTA) followed by voltage differencing differential difference unit (VDDDU). The symbol and equivalent circuit of VDDDA are shown in figure 1 (a) and (b), respectively. At the input voltage terminals (V+, V-, V_p, and V_n), they are high impedance. Also, it is high impedance at the output current terminal (z) and low impedance at the output voltage terminal (w). The difference of input voltage V+ and V- will be sent as a current I_z via transconductance (g_m). Generally, the g_m is varied and electronically tuned and the differential voltage of V_z, V_n and V_p will be send to be voltage V_w with the unity voltage gain. The ideal VDDDA is characterized by following equations." [9]

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