INTERFACING ELECTRONIC FOR MEASUREMENT, SIGNAL PROCESSING AND WIRELESS COMMUNICATION

Edited by

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IIUM PRESS

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

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Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011

Perpustakaan Negara Malaysia Cataloguing-in-Publication Data

Sheroz Khan, AHM Zahirul Alam & Anis Nurashikin Nordin: Interfacing Electronic for Measurement, Signal Processing and Wireless Communication.

ISBN: 978-967-418-171-0

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM
(Malaysian Scholarly Publishing Council)

Printed By:
IIUM PRINTING SDN.BHD.
No. 1, Jalan Industri Batu Caves 1/3
Taman Perindustrian Batu Caves
Batu Caves Centre Point
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Chapter 9

SWITCHED-CAPACITOR INTEGRATOR DESIGN

MA LI YA, SHEROZ KHAN, ANIS NURASHIKIN

The integrator is the largest and most important circuit block in the oversampling ADCs. Switch-capacitor integrator (SCI) perhaps is the most popular approach for realizing analog signal processing using CMOS technology. It accumulates the major quantization error from the quantizer and forces their average value to be zero (Boser & Wooley, 1988). It is realized by using of some basic building blocks such as op amps, capacitors, switches, as well as non-overlapping clocks. Brief descriptions of each blocks and the integrator's working principle are given in this chapter, expect op amps explained in following section.

9.1. TOPOLOGY CHOOSING

A popular solution for integrator design which is used in ADC is that of the switched-capacitor integrator. The basic building block of most SCI circuits is the stray insensitive integrator as shown in Fig. 9.1, which contains an op amp, two capacitors (C_1 and C_2), four MOSFET (the metal-oxide-semiconductor field-effect transistor) switches, and two non-overlapping clocks.

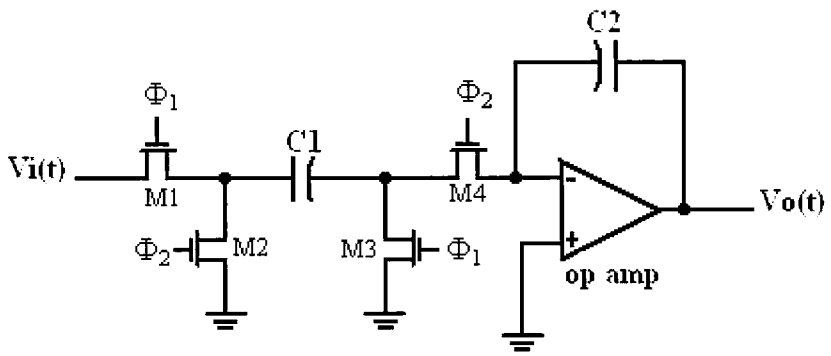

Fig. 9.1: Schematic of switched-capacitor integrator (SIC) (Mohan, et al., 2008).

There are two reasons for choosing the non-inverting SCI in oversampling ADCs here. First, until the early 1970s, analog signal-processing circuits still used continuous-time circuits consisting of resistors, capacitors, and op amp (Allen, et al., 2002). However, the absolute tolerances of resistors and capacitors available in standard CMOS technologies are not good enough (which can vary by as much as 20 percent) compared to SCI (the accuracy is on the order of 0.1 percent). The parasitic-insensitive integrator is a