INTERFACING ELECTRONIC FOR MEASUREMENT, SIGNAL PROCESSING AND WIRELESS COMMUNICATION

Edited by

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Chapter 27

MVL DESIGN AND CURRENT MODE CIRCUIT ELEMENTS

SOHELI FARHANA, AHM ZAHIRUL ALAM, SHEROZ KHAN

27.1. INTRODUCTION

Multiple-valued logic or multi-valued logic (MVL) can be considered as a mixture of both binary logic and analog signal processing and as a result, it has the ability to enrich digital electronics by incorporating the advantages of both binary logic and analog signal processing. Such capabilities include retaining the inherent noise resistance feature of binary systems as well as being able to represent more information in a single signal just as in the case of the analog signal. The use of MVL can also significantly reduce the amount of interconnection lines required to communicate within a chip and with other chips and hence reduce chip size. There is also a possibility of reducing the power consumption of chips since a reduction in interconnections will translate into lesser needs of capacitance which account for the major of dynamic power dissipation in submicron VLSI systems. A brief discussion is done in this chapter based on commonly used basic current-mode construction of cells in analog and multiple-valued logic (MVL). The discussion includes cells such as current mirrors and current comparators.

27.2. CURRENT-MODE CIRCUIT ELEMENTS

27.2.1. Current Mirrors

In all analog and mixed mode VLSI circuits, a current mirror (CM) is an integral part of signal processing elements. As the name suggests, a current mirror is used to generate duplication (if necessary, it may be attenuated or amplified) of a given reference current.

Some of the desirable characteristics of current mirrors are (Sung, Park, Seong & Kim, 2002) low AC equivalent input resistance, and small DC voltage drop at the input node high output resistance, so that the output current is independent of the output voltage, whether DC or AC low output compliance voltage1, such that maximum voltage swing at the output node is allow for good frequency response for high frequency applications linear current transfer ratio. In most cases the transfer ratio should be constant and ideally is set by the transistor geometry.

A simple realization of a MOS current-mirror is presented in Fig. 27.1. If one assumes that the transistors operate in the saturation region (VDS > VGS − VT) so that the drain current equation is