



Analog Mixed Signal based Linear Control of Electric Motor Deploying CapSense Technology

S. K. Tilekar, S. V. Chavan, S. N. Patil, B. P. Ladgaonkar and P. V. Mane-Deshmukh

VLSI Design & Research Centre, Post Graduate Department of Electronics, Shankarrao Mohite Mahavidyalaya, Akhuj,
Dist. Solapur, Maharashtra, India

Abstract- Confluence of Analog Mixed Signal (AMS) based embedded technology, innovative VLSI technology, with CapSense technology results into a system with commendable features. The industrial processes are discretely controlled by employing switches. However, to ensure linear and continuous controlling, the deployment of CapSense is recommended, wherein capacitive sensing principle is considered. Moreover, mixed signal based Programmable System on Chip (PSoC) from Cypress semiconductors plays vital role in AMS VLSI design. The CapSense has precise and ultra-soft interface, replacing mechanical contact, plays a significant role in variety of industrial gadgets. An embedded system is designed and implemented by utilizing AMS based PSoC5 device, CY8C55, from Cypress semiconductor, for linear controlling of electric motor, wherein complete embedded system is designed by configuring on-chip resources of the PSoC5 device. The device includes the soft core for interfacing of the touch sensitive pad. The capacitive sensing signal is very efficiently extracted by on-chip CapSense sigma delta modulator. The necessary on-chip hardware and software are dynamically co-developed to satisfy the needs of present design using PSoC Creator 2.1, an Integrated Development Environment. The ARM cortex M3 CPU is operating at back end. To drive electrical motor a MOSFET is deployed. On implementation, it is found that the motor speed can be precisely and linearly controlled.

Keyword: Analog Mixed Signal, CY8C55, CapSense, Electric Motor.

I. INTRODUCTION

Indeed, the Analog Mixed Signal (AMS) based Programmable System-on-Chip (PSoC) design, an innovative VLSI technology, exhibits commendable characteristics of dynamic reconfigurability, which realizes precision embedded system of desired applications [1]. Furthermore, CapSense technology, an emerging capacitive touch sensing, from a decade along with Human Machine Interface (HMI) systems makes revolutionary changes in electronics gadgets. Confluence of these two emerging innovative technologies, AMS PSoC and CapSense, replaces the various HMI applications in industries, bio-instrumentation [2], infotainment [3], domestic appliances, etc.

The every industry and household has used DC motor in their equipment. To improve the performance, maximum throughput, minimum power consumption, etc. need the precise as well as linear controlling of DC motors. Traditionally, adjustable speed controller and wide range of options have evolved for linear controlling of DC motors, such as rheostatic control method, flux control method, voltage control method, etc. are available. But the speed controllability and cheapness of are affected by parameter variations and disturbance torque [5]. The many investigators are developed the techniques based on MATLAB/SIMULINK [6], Kalman filter [7] and microcontrollers [8,9] but all these an embedded systems developed about microcontrollers and necessary hardware realize the System on Board (SoB) design. The SoB systems have high power consumption, less flexibility in hardware as well as software design, less static as well as dynamic reconfigurability, more hardware complexity, etc. [11]. Hence, the designers are looking towards the emerging VLSI technology called System-on-Chip (SoC) design, which is featured with reconfigurability of hardware and software as well. It exhibit ultra-low power consumption with significant driving as well as driven capabilities [10]. The SoC design, in early days, was limited to digital design only but recently due to MOS philosophy the analog devices are involved and AMS VLSI design and technology is emerged. To realize the AMS designing, PSoC core are launched by many vendors, Micro Semi, Actel, Cypress, etc., having own promising features. Therefore, PSoC cores have better solution for embedded system. The investigator Gupta et al [2] have designed and implemented adopting Cypress AMS PSoC based CapSense for blood glucose meter using saliva touch. Chiang et al [4] designed a semi cylindrical capacitive sensor interface circuit, which is implemented for flow rate measurement having range 0.136 to 4.746 L/min. Therefore, deploying Cypress AMS PSoC5, CY8C55 family, embedded system is synthesized for linear control of DC motor. The architecture of the CY8C55 family PSoC5 is depicted in the figure 1. The CY8C55 family provides high degree of both static as well as dynamic reconfigurable analog as well as digital cores and interconnect circuitry around a CPU subsystem [11]. The CPU subsystem has a powerful 32-bit ARM Cortex-M3 processor with a flexible analog subsystem, digital subsystem, routing and I/O enables a high level of integration for wide variety of complex applications.