ABSTRACT

Low Voltage Amplifier Architectural for High Frequency Switched Capacitance Circuits.

(May 2000)

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Increasingly a large number of electronic systems are centered around Application Specific Integrated Circuits (ASIC's). In many ASIC's, analog and digital signal processing functions are integrated on the same chip. Such circuits are also called mixed signal integrated circuits. Complementary Metal Oxide Semiconductor (CMOS) processes are preferred for the implementation of such circuits. Typically the functions of the analog portion of such chips include the conversion of analog information to digital information and filtering of signals before the digital portion of the chip processes them. Nowadays the trend is to reduce the power supply voltages for integrated circuits. The reasons for this are twofold. For increased digital circuit density and speed, device sizes must be reduced. At smaller device sizes, terminal voltages must be limited to prevent electrical breakdown. The other reason for lowering the supply voltage is to decrease the power consumption. For portable devices, the batteries also become less bulky. The lowering of power supply voltages makes the design of analog circuits more difficult. Since threshold voltages do not scale down proportionally with device sizes, transistors in analog circuits cannot have large effective gate to source voltages. This has the effect of degrading speed performance of analog circuits, since the transconductances of transistors decrease. Lowering the supply voltage also tends to decrease the dynamic range of analog circuits, since the output swing of analog circuits is limited by the supply.

Switched capacitor circuits are the most popular means of implementing analog signal processors. Gain stages, accurate filters, and high speed high resolution data converters can be implemented using switched capacitor circuits. Applications of switched capacitor circuits include digital video systems, (fig) portable communications devices (fig) and

data modems (fig). The three basic building blocks of a switched capacitor circuit are the capacitor, switch and operational (transconductance) amplifier (opamp/OTA). The focus of this research is the realization of a high performance low voltage amplifier architecture for switched capacitor (SC) circuits, and verification of the utility of the architecture by using it in a high speed switched capacitor filter.

Outline of Thesis: Chapter 2 will describe the switched capacitor. Basic switched capacitor circuits such as the integrator, gain stage and sample and hold circuit will be described. Building block requirements of switched capacitor circuits will be discussed, with emphasis on the operational amplifier. Chapter 3 will have a detailed discussion on the proposed new amplifier architecture. Chapter 4 will discuss simulation results and a biquadratic filter making use of the amplifier. Experimental results obtained for a 0.5μm process will be discussed in chapter 5. Chapter 6 will discuss some improvements which can be made. The thesis will wrap up with conclusions which are to be presented in chapter 8.