

Abstract

Because of its outstanding linearity and large dynamic range, oversampling Analog-to-Digital (A/D) converters based on Sigma-Delta Modulators (SDM) are widely used in low-frequency applications. In order to confer several important advantages including greater reliability, potentially lower power dissipation, and improved performance as technology scales, digitization, as well as SDM, gradually moves to high-frequency usage. However, due to its nature, oversampling A/D converters are much slower than their Nyquist-rate converters, this limiting the SDM usage in high-frequency applications.

The implementation of a high-frequency SDM that achieves a large dynamic range involves significant challenges that are explored in this research. This work describes a new N -path multirate architecture for a second-order SDM that is more tolerant of analog circuit limitations at high sampling rates than conventional implementations based on the use of switched-capacitor N -path filters. Nonideal effects relating to this new N -path multirate architecture, such as timing jitter, path mismatch, and potential instability are described and analyzed. A design example employing a four-path multirate topology has been simulated. The modulator with a four-path comb filter plus integrator clocked at 54MHz modulates a 3MHz chrominance signal with 50dB. The cascade comb decimation filter presents an effective structure for the elimination of path mismatches. The simulation results show that the degradation of the dynamic range of the modulator will stay within a 3dB range considering mismatch ratios of less than 0.4%.