

NTU IC-776CA Project Proposal

Wideband Sigma-Delta ADC for ADSL(Lite) Modem Application

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ADSL(Asymmetric digital subscriber loop)modem, in its upstream(from user to central office)data transmission, requires the ADC to sample the signal with high resolution (more than 12 bits) at relatively high bandwidth(100khz or more).

Traditionally, Sigma-delta converters have been restricted to the domain of high resolution and low bandwidth(audio) applications. In recent years, the bandwidth of Sigma-delta converters has expanded to hundreds of khz, and sometimes Mhz, regime. This expansion can be attributed to two general trends: CMOS device scaling and a number of new techniques to lower the oversampling ratio(OSR) while maintaining the high resolution.

In this project, I will attempt to design a Sigma-delta modulator that samples the signal with a resolution of at least 13 bits(78db) at 138khz bandwidth. Because of the high bandwidth, techniques such as multi-bit quantization and high-order modulator will be tried to bring the OSR down as low as possible. An anti-aliasing filter is also part of the project. Even if the design will be executed at block-level, assuming that required references and amplifiers are available, the practicality of implementing those blocks will be discussed and the performance degradation resulting from any infeasible circuit requirement will be analyzed.