单环四阶 Sigma Delta 调制器噪声传递函数设计

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摘 要： 为了解决单环结构高阶 Sigma Delta 调制器的信噪比与输入动态范围的矛盾，利用巴特沃斯滤波器和切比雪夫 II 型滤波器设计了一个单环四阶 Sigma Delta 调制的噪声传递函数，使得系统获得较高信噪比的同时还具有良好的输入动态范围.仿真结果表明，系统峰值信噪比达到了 131.9 dB，同时将噪声传递函数参数映射成 FeedForward Feedback 结构的模型参数，并对其进行了归一化输入幅值为-3 dB 的 simulink 仿真，此时系统仍能获得 128.7 dB 的信噪比，说明系统具有良好的输入动态范围.该设计方法也可以扩展到更高阶、多位量化器和其他过采样率的 Sigma Delta 调制器设计中.

关键词： Sigma Delta 调制器；噪声传递函数；信噪比；巴特沃斯滤波器；切比雪夫 II 型滤波器

Design of a Noise Transfer Function for Single-loop 4th-order Sigma Delta Modulators

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Abstract： In order to solve high-order single-loop structure Sigma Delta modulator SNR contradiction with input dynamic range，Butterworth filter and the Chebyshev type II filter are used to dedign a Noise Transfer Function for single-loop 4th-order Sigma Delta Modulators, so that to obtain a higher signal to noise ratio of the system also has a good input dynamic range. The simulation results show that the system has reached the peak signal to noise ratio 131.9dB. While the noise transfer function parameters are mapped into the model parameters of FFFB structure, and normalized amplitude of -3dB input was selected for simulink simulation.We got 128.7dB of SNR from the simultation, which indicated that the dynamic range of the system is of good performace. The method mentioned in this breif can also be extended to higher order, multi-bit quantizer and other oversampling rate Sigma Delta modulator design.〖JP〗

Key words： sigma delta modulator; noise transfer function; SNR; Butterworth filter; Chebyshev type II filter

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