基于 Matlab 的宽带连续时间 Sigma-Delta 调制器设计

王盟皓，侯训平，陆铁军
（北京微电子技术研究所，北京 100071）

摘　要：　本文利用 Matlab 集成工具箱设计了一款单环三阶三位连续时间 Sigma-Delta 调制器.与离散时间调制器相比，连续时间调制器虽然对非理想因素较为敏感，但其在功耗、带宽方面却有着突出的表现.本文在设计过程中，加入了零阶反馈环路对额外环路延时进行吸收，并对连续时间调制器最主要的三种非理想特性进行了分析.最终基于 65 nm CMOS 工艺，设计电路并完成版图，通过 spectre 仿真，本文设计的调制器在 10 MHz 带宽下，可以达到 78.20 dB 的信噪失真比，且功耗仅为 5.39 mW.

关键词：　Matlab；连续时间 Sigma-Delta 调制器；宽带；低功耗

Design of wide-band continuous-time sigma-delta modulator based on matlab

WANG Meng-hao, HOU Xun-ping，LU Tie-jun

(Beijing Microelectronics Technology Institute, Beijing 100071,China)

Abstract：　This paper presents a single-loop 3rd-order 4-bit Continuous-Time Sigma-Delta modulator using the Matlab toolbox. Compared with Discrete-Time modulators,continuous-time modulators are sensitive to non-ideal factors, but they have outstanding performance in terms of power consumption and bandwidth. In the design process, a zero-order feedback loop is added to absorb the excess loop delay, and the three main non-ideal factors of the continuous-time modulator are analyzed. Finally, based on the 65nm CMOS process, the circuit and layout of the modulator is completed. Through spectre simulation, the modulator can achieve 78.20dB signal to noise and distortion ratio with bandwidth of 10MHz, while the power consumption is only 5.39mW.

Key words：　Matlab；continuous-time Sigma-Delta modulator；wide-band；low-power

作者简介：
王盟皓　男，（1995-），硕士研究生.研究方向为射频集成电路设计.
侯训平　男，（1984-），高级工程师.研究方向为射频集成电路设计.
陆铁军（通讯作者）　男，（1963-），博士，研究员.研究方向为 VLSI 设计、片上系统集成.
E-mail：3515037181@qq.com