

一种使用时间斜移整形技术的 $\Delta \Sigma$ 时间数字转换器

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摘要: 本文提出了一种使用门控环形振荡器及时间斜移整形技术的 2-0 级联结构的 $\Delta \Sigma$ 型 TDC. 该 TDC 使用了一个环形 DTC 和基于时间寄存器的时域加法器, DTC 通过与 GRO-TDC 共享量化器从而无需校准并且降低了功耗. 通过将 GRO 量化器的输出分割为 MSB 和 LSB 部分, 环形 DTC 的精度要求被进一步降低. 利用该时间斜移整形技术, GRO 的时间斜移误差被一阶整形, 同时死区效应被解决. 与此同时, 实现了量化噪声的二阶整形. 该项技术易于在宽带和低功耗方面得到应用.

关键词: 时间数字转换器; 时间斜移; 门控振荡器; $\Delta \Sigma$ 调制器; 噪声整形

A Gated Ring Oscillator Based $\Delta \Sigma$ Time to Digital Converter

Using Time-Skew Shaping Technique

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Abstract: A 2-0 cascade gated-ring-oscillator (GRO) based $\Delta \Sigma$ time-to-digital converter (TDC) using time-skew shaping technique is presented in this paper. The proposed TDC includes a ring digital-to-time converter (Ring-DTC) and a time-register (TR) based time-domain adder. By sharing the intrinsic gated-ring quantizer of GRO-TDC, the Ring-DTC has performed no additional matching requirement, calibration free and low power consumption. By dividing the outputs of the GRO quantizer into an MSB segment and an LSB segment, the resolution requirement of Ring-DTC is further released. With the proposed time skew shaping technique, the time-skew of GRO is 1st order shaped, and the dead-zone effect is solved. At the same time, 2nd order quantization noise shaping is achieved. This technique is simple to implement and well suited for low-power and wide-band applications.

Key words: time-to-digital converter (TDC); time-skew; gated-ring-oscillator (GRO); delta-sigma modulator; noise shaping

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