Abstracts

Optically sampled analog-to-digital converters

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Optically sampled analog-to-digital converters (ADCs) combine optical sampling with electronic quantization to enhance the performance of electronic ADCs. In this paper, we review the prior and current work in this field, and then describe our efforts to develop and extend the bandwidth of a linearized sampling technique referred to as phase-encoded optical sampling. The technique uses a dual-output electrooptic sampling transducer to achieve both high linearity and 60-dB suppression of laser amplitude noise. The bandwidth of the technique is extended by optically distributing the post-sampling pulses to an array of time-interleaved electronic quantizers. We report on the performance of a 505-MS/s (megasample per second) optically sampled ADC that includes high-extinction LiNbO/sub 3/ 1-to-8 optical time-division demultiplexers. Initial characterization of the 505-MS/s system reveals a maximum signal-to-noise ratio of 51 dB (8.2 bits) and a spur-free dynamic range of 61 dB. The performance of the present system is limited by electronic quantizer noise, photodiode saturation, and preliminary calibration procedures. None of these fundamentally limit this sampling approach, which should enable multigigahertz converters with 12-b resolution. A signal-to-noise analysis of the phase-encoded sampling technique shows good agreement with measured data from the 505-MS/s system.

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