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Parameterization of Nonideal Quantizers for Simultaneous Estimation of Quantizer and Excitation Signal Parameters

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Abstract

This paper deals with the estimation of signal and quantizer parameters based on a nonideally sampled and quantized measurement record. It proposes solutions to reduce the inherently high-dimensional parameter space via approximation of the quantizer nonideality to make the computation possible in PC/MATLAB environment. The performance of the approximation techniques is examined as well. The computational demand of the proposed approximate maximum likelihood (AML) estimators is investigated and compared to the computational demand of the maximum likelihood (ML) estimators without approximation.

Keywords: quantization, parameter estimation, maximum likelihood, ADC testing, approximation, nonideal quantizers

1. Introduction

Modern data acquisition and control systems process digital signals which aim to represent the information contained by the analog signals of the physical environment. Since analog-to-digital conversion is performed by real devices, the quantization and the sampling of the signals is necessarily nonideal. To evaluate the digital measurement records properly it is required to estimate the parameters of the analog signal reflecting to the nonideality of the measurement channel. Using maximum likelihood (ML) [1] estimation of quantizer and signal

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