Theory For Fast And Cost-Effective Frequency Response Estimation Of Systems

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Vision, Image and Signal Processing, IEE Proceedings -;Publication Date: 30 Dec. 2004;Vol: 151,Issue: 6
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Summary

Frequency response, and hence transfer function, estimation of systems is of vital importance in several engineering fields such as signal processing, communications, control, system modelling and identification. Any digital frequency response scheme with attractive features such as low cost, high speed, good accuracy and excellent noise and harmonic rejection capabilities will therefore be of great practical benefit to practitioners in the above-mentioned fields. The author reports on a new frequency response estimation theory, based on the concept of non-subtractively dithered quantisation, which endows the classical quadrature correlation-based frequency response estimation scheme with all the above-mentioned attractive features. A theoretical analysis of the estimation (bias and variance) accuracy of this technique is given. The theory is tested on a number of filters and under some stringent conditions characterised by the coarsest possible (1-bit) quantisation scheme and very noisy (low SNR) environments. Simulation results substantiate the proposed theory quite well, thus making the VLSI implementation of the proposed 1-bit estimation scheme on a chip an attractive proposition.