On The Exact Recovery Of The FFT Of Noisy Signals Using A Non-Subtractively Dither-Quantized Input Channel

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Summary

Through several algorithmic changes, the FFT and its variants have not only breathed a new lease of life into an otherwise latent classical DFT algorithm but also led to an explosion of applications in numerous areas. In all these applications of the Fourier transform, the FFT input has always been assumed to be sufficiently highly quantized so as to minimize, to a negligible level, an otherwise adverse effect of all quantization errors involved. A coarse quantization of the FFT input, with all the practical advantages that it entails, and an acceptable FFT estimation accuracy therefore seem to conflict with each other. This paper proposes a new theory that resolves this conflict for any quantization resolution used. This theory, tested with a 1-bit quantization scheme and under very noisy environments is very well supported by our simulation results. This makes the possibility of a hardware implementation of a 1-bit FFT chip a goal worth pursuing.