Efficient High Fidelity Signal Reconstruction Based on Level Crossing Sampling

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Abstract : This paper proposes strategies in level crossing (LC) sampling and reconstruction that provide high fidelity signal reconstruction for speech signals; these strategies circumvent the problem of exponentially increasing number of samples as the bit-depth is increased and hence are highly efficient. Specifically, the results indicate that the distribution of the intervals between samples is one of the key factors in the quality of signal reconstruction; including samples with short intervals do not improve the accuracy of the signal reconstruction, whilst samples with large intervals lead to numerical instability. The proposed sampling method, termed reduced conventional level crossing (RCLC) sampling, exploits redundancy between samples to improve the efficiency of the sampling without compromising performance. A reconstruction technique is also proposed that enhances the numerical stability through linear interpolation of samples separated by large intervals. Interpolation is demonstrated to improve the accuracy of the signal reconstruction in addition to the numerical stability. We further demonstrate that the RCLC and interpolation methods can give useful levels of signal recovery even if the average sampling rate is less than the Nyquist rate.