Detection of Fast Moving Pulses in a Noisy Environment

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(ABSTRACT)

We develop and analyze a combination of techniques to improve timing measurement accuracy of systems processing Gaussian pulses distorted by noise. The approach involves M/N detection, integration, and either correlation or threshold timing measurement techniques. The gain of this process is an increase of the detection capabilities of the system: improvement of the detection probability and decrease in false alarm probability, reduction in pulse distortion, and increase of the accuracy of time delay measurements between pulses using either threshold or correlation measurement methods. Each element of the proposed architecture is studied separately, and modeled analytically. As a result, a design method is proposed in order to develop an appropriate solution to any system requiring accurate time delay measurements in noisy environments. This general method is then applied to a real system, and the results in terms of detection improvement and rms timing error of the method meet expectations: the signal to noise ratio (SNR) operating point of the system is lowered by 10dB, and correlation proves to generate 2dB less rms timing error than threshold.