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Design and analysis of a phase difference measurement system with improved performance.

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The accuracy or error of a phase difference measurement between two different sinusoidal signals is significantly affected by the noise in them. Quadrature Demodulation (QD) is one of the methods used for calculating the phase difference under considerable noise levels especially in discrete-time measurement systems. Even though the accuracy of the usual QD method may be sufficient enough for some environments, in conditions that involve noise levels that is reasonably larger, higher accuracy is much desirable. In this paper, an improved QD method to decrease the phase error and thus increase the accuracy of a phase difference measurement is proposed and established. The increased accuracy of the measurements are confirmed by experimental methods using input signals of signal-to-noise ratios (SNRs) ranging from 6.00 dB to 30.0 dB. When compared with the usual QD method, the experimental results for the phase error measurements have proven that under similar time consumptions, the proposed method is more accurate by a factor of greater than 2 to 4. Even at the worst SNR level at 6.00 dB the proposed method is more accurate by a factor of greater than 2 and the phase error is no more than 0.1^{o} for 100 single averaged measurements of the phase differences. At higher SNR levels the accuracy of proposed method further increased up to a factor of 4.4. The proposed method could be used in discrete-time phase measurement systems with a higher accuracy.

Keywords: Phase difference, Noise, Accuracy, Error

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