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Kalman Filter for tracking a noisy cosinusoidal signal with constant amplitude
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Abstract
This paper presents a Kalman filter based approach in order to solve the problem of tracking a noisy cosinusoidal signal with constant amplitude in the presence of noise. The objective is to estimate the state of the signal accurately, considering the inherent challenges posed by noise corruption. The Kalman filter is utilized as the core algorithm for state estimation, leveraging its ability to combine noisy measurements and a dynamic model to provide optimal estimates. The filter is initialized with zero states and covariance, and the state and covariance estimates are iteratively updated using time updates and measurement update equations. Through extensive simulations, the performance of the proposed Kalman filter-based algorithm is evaluated. The results demonstrate its effectiveness in accurately tracking cosinusoidal signals and mitigating the impact of noise. the Kalman Filter algorithm in this system produces low MSE at about 0.021 and MAE at about 0.111. The metrics results signify the algorithm's ability to filter noise and estimate the actual state of the system, reflecting its robust tracking performance. The simulation results validate the effectiveness of the proposed approach and highlight its potential to enhance signal tracking accuracy in the presence of noise. Further research can explore the algorithm's performance in various scenarios and investigate additional modifications to increase its robustness in challenging environments.

Author Keywords
Cosinusoidal signal; Gaussian noise; Kalman filter. Signal tracking; Mean squared error; State estimation

Index Keywords
Gaussian noise (electronic), Iterative methods, Mean square error, State estimation; Constant amplitude, Cosinusoidal signal, Filter-based, Gaussian noise, Gaussians, Kalman filter., Mean squared error, Noise corruption, Signal tracking, State and covariances; Kalman filters

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