# Reconstruction of Multiple Structural Response Types under Unknown Measurement Noise (Postprint)

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## Abstract

To address the challenges of measurement noise variance estimation and multi-type response reconstruction when using the traditional Kalman filter (KF) algorithm for structural response reconstruction, a method integrating noise variance estimation and multi-type response reconstruction is proposed. First, an approximate computation method is introduced into the moving-window Kalman filter algorithm, and a recursive moving-window Kalman filter (RMWKF) algorithm is proposed to recursively estimate the measurement noise variance in real time. Then, based on measurement data from strain gauges and accelerometers at limited locations and combined with the modal method, the strain, displacement, velocity, and acceleration responses at various locations of the structure are reconstructed. Finally, numerical simulations and experimental analyses are conducted on a two-dimensional truss and a cantilever beam, respectively, to verify the effectiveness of the proposed method. The experimental results demonstrate that the proposed method can effectively estimate the measurement noise variance, achieve effective multi-type structural response reconstruction, and simultaneously reduce data storage space and computational cost.

## Full Text

## Preamble

The provided text consists entirely of corrupted data, encoding artifacts, and mathematical placeholders with no recoverable Chinese content. Following the instruction to skip garbage text and meaningless fragments, only the section heading is preserved.

*Note: Figure translations are in progress. See original paper for figures.*