A new data assimilation framework using the modified Constitutive Relation Error for online structural monitoring: application to shaking-table experiments

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Keywords: Data assimilation, Kalman filtering, modified Constitutive Relation Error, Low-frequency dynamics, Shaking-table experiments, Earthquake Engineering

Recently, a first step towards the integration of numerical models in shaking-tables control strategy has been performed in \cite{1} where an offline model updating framework based on the minimization of a modified Constitutive Relation Error functional (mCRE) has been tailored to low-frequency dynamics. Following the strategy proposed by \cite{2}, we address here sequential data assimilation by integrating the mCRE as new observer within a dual Unscented Kalman filter, leading to a new modified Dual Kalman filter algorithm (MDKF). After being validated using synthetic data, the methodology has successfully processed actual measurements of the SMART2013 benchmark. In the latter is emphasized the possibility to perform real-time monitoring of complex structures undergoing nonlinear phenomena (see FIG. 1). The good correlation with former identification results \cite{1} illustrates the relevance of this new approach for online structural monitoring and suggests promising use of MDKF for adaptive control design purposes.

![Figure 1: Tracking the first eigenfrequency of the SMART2013 specimen using MDKF.](image)

REFERENCES

\cite{1} M. Diaz, P.-É. Charbonnel, L. Chamoin, \textit{Robust energy-based model updating framework for random processes in dynamics: application to shaking-table experiments}. Accepted for publication in Computers and Structures - \texttt{hal-03528432}