8th World Conference on Structural Control and Monitoring (8WCSCM)
Orlando, FL, USA 5-8 June 2022

Multi-Channel Missing Data Recovery For Structural Health Monitoring Via Structured Low-Rank Matrix Completion

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In structural health monitoring, data missing is a common issue during the long-term monitoring process, which undermines the usability of the collected data. Although sparse representation and compressed sensing have achieved tremendous success in missing data recovery, they mainly focus on single-channel data recovery and rely on a prior known sparse domain. Compared to them, rank constraint is more versatile when recovering multi-channel signals without specifying a sparse basis. In this paper, we propose a novel approach based on structured low-rank matrix completion to achieve simultaneous recovery for multi-channel data. By arranging the multi-channel data into a Hankel structure, the newly constructed Hankel matrix should be low rank. Then the data recovery problem is formulated as a nonconvex optimization problem and the recovery process could be realized via nuclear norm minimization. To investigate the recovery accuracy of the proposed method, a five-story building model is employed as a testbed. A case study is conducted to illustrate the recovery ability of the proposed method for multi-channel signals.