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Keynote Paper

Sparse Structural System Identification of Linear and Nonlinear Systems

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ABSTRACT

This keynote lecture addresses important problems of sparse output-only identification, sparse input-output identification of linear and nonlinear structures, and structural damage detection. Sparse component analysis based linear modal identification method for underdetermined problems using L1-minimization is presented. Structural damage localization and damage severity identification by means of sparse representation and L1-minimization recast as classification problem is presented. A new system identification technique suitable for single degree of freedom (SDOF) and multiple degree of freedom (MDOF) structural systems with either nonlinear elastic or inelastic/hysteretic behavior is presented. The method is a parametric modeling technique based on sparse regularization. The proposed framework is capable of discovering the underlying governing equations of the system of interest from input-output data. New method includes functions that allow the discovery of significant nonlinearities, and hysteretic or inelastic behavior with permanent deformation. Model selection using sparse regularization and cross validation using Akaike criteria. Experimental validation of the technique is presented. A new two stage semi-supervised technique for nonlinear structural system identification is presented. In conclusion broad class of problems in which the presented new method(s) of sparse structural identification are applicable is discussed.

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