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Parametric identification of non linear structures using Particle Swarm Optimization based on power flow balance criteria

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Abstract: This paper discusses a novel approach for nonlinear parameter identification of structures. An optimization problem was formulated as an inverse problem, using two objective functions in time domain. The first objective function is formulated as an error between measured acceleration and predicted acceleration of the model. While the second objective function minimizes the substructure Instantaneous Power Flow Balance, which is the sum of input power, dissipated power, transmitted power and time rate of kinetic and strain energy to zero. Here a cubic nonlinearity in spring (Duffing equation) and a quadratic nonlinearity in damper are used to model the nonlinear system. Numerical simulations were performed on a 10-DOF nonlinear system under harmonic excitation using Particle Swarm Optimization tool under noise-free and 5% noisy cases. Identified results are compared in terms of mean absolute percentage error, with other methods in nonlinear parameter identification available in literatures. Simulation results show the accuracy of proposed method in nonlinear parameter identification even at high noise contamination cases.

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