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Identification of nonlinear joint interface parameters using instantaneous power flow balance approach

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Abstract: Joints in assembled structures can affect the dynamic behaviour of mechanical structures under dynamic loading conditions. Mathematical modelling of such structures, one need to consider the joint interface effects accurately. In this paper a bolted lap joint is modelled with a nonlinear spring and a damper to simulate the nonlinear effects like softening phenomena due to slip, associated with the joint structures. The known parametric model of the assembled beam structure with joint interface non-linearity was simulated 'experimentally' under a harmonic external excitation to find the responses. The parameter identification was formulated as an inverse problem using Particle Swarm Optimization algorithm. The error between experimentally measured and numerically predicted response matching and a novel Instantaneous Power Flow Balance criteria based objective functions are used for the identification of nonlinear parameters. The analysis was carried out on noise polluted response data to examine the performance of the proposed method under noisy conditions. The identified nonlinear parameters show the accuracy of the current method over other time domain methods.

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