Sparse representation for the impact force acting on composite structures

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Identifying the impact force acting on composite structures is vital for structure health monitoring. However, impact force identification remains a challenging inverse problem, where a small error in structural responses may lead to a large deviation in the true solution. To overcome the ill-posed nature, a general sparse representation model is developed thereafter for solving the inverse problem of impact force identification. Different from the traditional function expansion methods that should determine the number of basis function in advance, the sparse representation method can adaptively determine it by minimizing the number of nonzero components in the sparse coefficient vector during the regularization process. Compared with the Tikhonov method, four dictionaries including Dirac delta functions, Db6 wavelets, Sym4 wavelets and cubic B-spline functions, accurately represent the consecutive impact force acting on a carbon fiber reinforced composite laminates plate.