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APPLICATION OF MULTIOBJECTIVE OPTIMIZATION BASED ON DIFFERENCES OF MODAL DISPLACEMENTS AND MODAL ROTATIONS FOR DAMAGE QUANTIFICATION IN BEAMS

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Abstract: This paper presents an application of multiobjective optimization for the damage quantification in beams. The simulation of damage relies on the finite element analysis of Euler-Bernoulli beams and is carried out by considering a reduction in the Young's modulus of specific elements. The damage is quantified by minimizing two objective functions. These two functions are based on the difference in the Frobenius norm of matrices containing the modal displacements and the modal rotations of a beam in the undamaged and damaged states. The solution of the optimization problem thus defined is solved by a direct multisearch algorithm, which is an extension of the direct search algorithm to multiobjective optimization. This algorithm does not need any derivatives information about the objective functions. The validity, robustness and efficiency of the present application is tested for different boundary conditions of the damaged beam and high levels of noise in the simulated measured data.