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Optimal Force Action and Reaction in Structural Design and Identification

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Two main classes of optimization problems are discussed in the paper: optimal loading distribution providing maximal or minimal structural response and optimal loading for structural identification providing maximum of the distance measure between the computed response of a model and the response of the actual structure measured in an experiment. Various measures of structural response are discussed, namely the total potential energy as a measure of the global stiffness, quadratic norm of displacement vector or arbitrary functional expressed in displacements. Derived optimality conditions for the optimal force action have the form of the solution of respective eigenvalue problems and result in coaxiality of loads with displacements (or adjoint displacements). Optimal identification problems are formulated and solved as min-max problems. Various distance measures I are discussed. The functionals I are maximized with respect to load coordinates and minimized with respect to model parameters in a step-wise procedure.

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