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STRUCTURAL OPTIMIZATION WITH EIGENVALUES BASED ON SEMIDEFINTE PROGRAMMING

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Nonlinear Semidefinite Programming (SDP) deals with the minimization of an objective function with semidefinite constraints on nonlinear symmetric matrix-valued functions. Here we also include standard nonlinear equality and/or inequality constraints.

SDP has a crucial importance for structural optimization, in problems involving eigenvalues. This is the case when considering constraints on the natural frequencies or imposing global stability.

The present formulation is based in the FAIPA-SDP, the " Feasible Arc Interior Point Algorithm for SDP", an interior point algorithm that solves Karush-Kuhn-Tucker condition for SDP employing Newton like iterations, [1] and is a generalization of the FAIPA, for classical nonlinear constrained optimization, [2].

FAIPA_SDP constructs a descent sequence of points at the interior of the feasible set, defined by the classic and the semidefinite inequality constraints. The algorithm performs Newton-like iterations to solve the first order Karush-Kuhn-Tucker optimality conditions for the SDP problem. At each of the iterations, three linear systems with the same coefficient matrix must be solved. The first one generates a descent direction of the cost function. In the second linear system, a precisely defined perturbation in the left hand side is done and, as a consequence, a descent feasible direction is obtained. The third system computes an estimate of constraint's curvature in order to get a feasible descent arc. An inexact line search along this arc is then performed, to ensure that the new iterate is interior and the objective is lower.

We describe some models for structural optimization involving SDP and solve a set of test problems. The results suggest efficiency and high robustness of the proposed method.

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