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GENERALIZED SUPPORT SET INVARIANCY SENSITIVITY ANALYSIS IN LINEAR OPTIMIZATION

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Abstract. Support set invariancy sensitivity analysis deals with finding the range of the parameter variation where there are optimal solutions with the same positive variables for all parameter values throughout this range. This approach to sensitivity analysis has been studied for Linear Optimization (LO) and Convex Quadratic Optimization (CQO) problems, when they are in standard form. In practice, most problems are in *general form*, in addition to nonnegative variables and equalities, they include free variables and inequalities. The LO problem in general form can be converted into the standard form, but this transforming changes the meaning of the support set invariancy sensitivity analysis.

In this paper, we consider the primal and dual LO problems in general form and introduce the associated general standard form. It is shown that investigating support set invariancy sensitivity analysis for this general standard form is able to accommodate not only the support set invariancy sensitivity analysis for usual standard form, but also the classic study of sensitivity analysis based on simplex methods as well as the recent point of view of sensitivity analysis based on interior point methods.

1. **Introduction.** Optimization is one of the most important tools to ensure efficient use of scarce resources. During the last half-century, many attempts have been made to expand the applicability of optimization methods. Linear optimization (LO) [2] was the first, and is still one of the main tools to model practical problems. LO was followed soon by other formulations, such as convex quadratic optimization, and more recently semi-definite optimization [1] is proved to be a powerful tool to model, solve and analyze economic, industrial and engineering problems. The two decades of interior point methods (IPMs) [15] enhanced our ability to solve very large scale problems in a reasonable time. IPMs forced us to reconsider the fundamental question of parametric and sensitivity analysis:

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