Symmetric duality in optimization and applications*

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As is well known, many natural, technical and economic processes are described in the form of optimization problems. Duality theory is important part of optimization theory. Special constructions – dual problems of optimization – are applied to many types of optimization problems.

They are used for the proof of optimality of solutions, for design and a theoretical justification of optimization algorithms, for physical or economic interpretation of received solutions. Quite often dual problems introduce new meaning to modeled problem. For example, economic resources optimal allocation dual problems are usually models of rational pricing.

It is possible situation when the dual problem to a dual optimization problem coincides with an initial optimization problem. This case is named [1] symmetric duality. It is known, that the symmetric duality is applied for linear programming problems and in some cases (depending on rules of dual problem definition) for problems of quadratic programming.

Results of study of a symmetric duality for problems of convex function minimization with linear constraints will be considered in the paper. These developments are based on conjugate Fenchel functions [2] and theorems of alternative linear inequalities systems [3]. Following areas of the received results application are considered:

1. Designing of effective algorithms for solving systems of equations and inequalities. Theoretical justification of A.I. Golikov and J.G. Evtushenko "alternative approach" [4], developed in theirs papers, to designing algorithms for solving linear inequalities systems and linear programming problems.

2. Regularization of improper linear programming problems that was investigated in I.I. Eremin works [5].

3. Flow distribution models [6] that applied to study of electric and hydraulic circuits, nonlinear transport problems.

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