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Optimization of wireless networks performance: An approach based on a partial penalty method

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Abstract

© 2017, North Atlantic University Union. All rights reserved. We study an optimization problem for a wireless telecommunication network stated as a generalized transportation problem (TP), where m (the number of “sellers”) is the number of network providers, and n (the number of “buyers”) is the number of connections established at a given time moment. Since in practice initial data of such problems are, generally speaking, inexact and/or vary rather quickly, it is more important to obtain an approximate solution of the problem (with a prescribed accuracy) within a reasonable time interval rather than to solve it precisely (but in a longer time). We propose to solve this problem by a technique that explores the idea of penalty functions, namely, the so-called Partial Penalty Method (PPM, for short). As distinct from exact solution methods for TP (e.g., the method of potentials), our approach allows us to further extend the class of considered problems by including to it TP with nonlinear objective functions. As an example, we consider a TP, where the objective function (expenses connected with resource allocation) is such that the price of the unit amount of the resource is not constant but depends on the total purchase size. In addition, we study the limit behavior of solutions to TP whose data are subject to fading disturbances. Since in our approach the initial point is not necessarily admissible, we use an approximate solution of each problem as the initial point for the next one. As expected, under certain requirements to disturbances the sequence of solutions to “disturbed” problems tends to a solution of the limit problem. We prove experimentally that PPM is more efficient than the usual variant of the Penalty Function Method (the Full Penalty Method, or FPM). The preference of PPM over FPM is more evident for n much greater than m.

Keywords

Approximate solution, Decaying perturbations, Limit behavior, Network connection, Nonlinear objective function, Open transportation problem, Optimization, Penalty function methods, Provider, Random disturbances, Telecommunication networks

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