A mixed integer nonlinear programming model for optimizing a gas pipeline transmission linear network

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Abstract

The technical equipment developed and used in both installation and operation processes in refineries, oil and gas pipelines, and gas booster stations has always been expensive. Hence, managers at different organizational levels are keen to find methods to control and reduce these costs. Generally speaking, the operators in a gas booster station choose the operating devices without considering the related costs. This research presents a mixed integer nonlinear programming model designed to minimize the operational costs of gas booster stations in a main pipeline distribution network. The goal is to optimize the choice of operating devices in these stations to minimize costs while still meeting customer demands. Turbo compressors are chosen as the operating devices and the operational costs are fuel, maintenance, start-up, and penalty costs. However, the significance indexes of these costs are valued differently by the three expert managers: the executive officer, operating head, and the overhaul repairing director. Consequently, the analytical hierarchy process (AHP) method is used to calculate the overall weights of costs, and a gas transmission company in the north of Iran is considered as a case study. The model can minimize the total cost, when compared to the selections of ten experienced operators; however, the absolute weights of choosing measures and the essence of the objective function under study mean that an operator choice exists that would represent the optimum selection of turbo compressors.

Keywords

Cost Benefit Analysis; Optimization; Natural Gas Transmission Network; Turbo Compressor; Mixed Integer Nonlinear Programming; Analytical Hierarchy Process

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