A network simplex algorithm for the minimum distribution cost problem

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The minimum cost flow problem seeks an optimal flow assignment over a network satisfying the node flow balance constraints and arc flow bounds constraints. These constraints are too simplified to model some real cases. To model the distillation or decomposition of products in some manufacturing processes, a minimum distribution cost problem (MDCP) on a specialized manufacturing network flow model has been investigated. In an MDCP, a specialized node called D-node is used to model a distillation process which only connects with a single incoming arc and several outgoing arcs. The flows entering a D-node have to be distributed according to a pre-specified ratio associated with each of its outgoing arcs. Such a proportional relationship between the arc flows associated with each D-node complicates the problem and makes the MDCP harder than conventional min-cost network flow problem. A network simplex algorithm for uncapacitated MDCP has been outlined in literature, but its detailed graphical procedures such as initial basic feasible solution computation, dual variables updates, and flow pivoting operations have not yet been given. In this thesis, we resolve these issues by upper bound techniques as well as graphical operations which decompose each pivoting graph into several components for calculating both the arc flows and the dual variables. Other issues regarding efficient ways to obtain an initial primal basic feasible solution to start with our algorithm and mathematical insights for solving the MDCP on distribution networks will also be investigated and discussed.

***Keywords*:** network optimization, minimum distribution cost problem, minimum cost flow, network simplex algorithm

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