Engineering Management, Information, and Systems

Extreme-point Tabu Search Heuristics for Fixed-charge Generalized Network Problems

Ph.D. Dissertation Defense

Angelika Leskovskaya
Advisor: Dr. Richard Barr
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Abstract: While the generalized transportation problem and extensions have been widely studied and applied, the addition of fixed charges provides a powerful enhancement with new modeling possibilities. This research develops an efficient heuristic solution approach to the fixed-charge generalized transportation problem and provides computational testing to demonstrate its effectiveness in terms of speed and quality of solutions to these mixed-integer models. Computational comparisons with the commercial state-of-the-art solver CPLEX 12 show that this extreme-point tabu search algorithm runs, on average, five orders of magnitude faster and produces integer solution values within and average of 2.2% of optimal.

Another heuristic is developed for solving the fixed-charge generalized transshipment network for problems of larger sizes. This extreme-point tabu search method incorporates dynamic linearization and is tested on problems with up to 10,000 nodes and 100,000 arcs. This approach produces solutions within 2.5% of best-known objective values and is 1000 times faster than the commercial solver CPLEX.

These new heuristics, software implementations, problem generator, experimental test set, and computational results fill gaps in the published research. Computational results verify the high efficiency of the extreme-point tabu search approach and demonstrate the solvability of large-scale fixed-charge generalized transportation and transshipment network problems of dimensions encountered in industry applications.

Bio: Angelika Leskovskaya is an Operations Research PhD Candidate in the Lyle School of Engineering's Department of Engineering Management, Information, and Systems at Southern Methodist University in Dallas, Texas. She holds an MA in Applied Mathematics and a MA in Economics from the Belarussian State University.