Managing Congestion in a Dynamic Multi-Modal Facility Location Problem

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Abstract

This paper presents a mathematical model that studies the impacts of the congestion effect in a dynamic multi-modal facility location design problem. A mixed integer non-linear programming (MINLP) model is developed by considering the impacts of biomass feedstock seasonality and facility congestion to determine the optimal use of multi-modal facility location during a given time period. The MINLP problem is first linearized using piecewise functions and then solved using a hybrid Benders-based rolling horizon algorithm. The performance of the algorithm was tested using a case study with data from the Southeast U.S. The numerical experiments show that this proposed algorithm can solve large-scale problem instances to a near optimal solution in a reasonable amount of time. Extensive numerical analyses were conducted to show the range of impacts of dynamic multi-modal facility location decisions, congestion costs and biomass feedstock seasonality on supply chain network performance. Results reveal that the unit biomass delivery cost increases up to 4.8% if the impacts of congestion are taken into consideration.

Keywords
Biomass supply chain, dynamic multi-modal facility location, Benders decomposition, rolling horizon heuristic

Biography

Dr. Mohammad Marufuzzaman received his Ph.D. in Industrial & Systems Engineering from Mississippi State University in 2014. He received his MASc degree in Industrial Systems Engineering from University of Regina, Canada in 2010 and B.Sc degree in Industrial & Production Engineering from Shah Jalal University of Science & Technology, Bangladesh in 2006. He joined Industrial & Systems Engineering department as an Assistant Professor in August 2015. His main areas of interest are in supply chain optimization with applications in renewable energy, stochastic programming, decomposition methods, solving large scale supply chain network problems and supply chain risk management. Dr. Maruf's publications have appeared in journals such as Transportation Science, Computers & Operations Research, Transportation Research Part E, International Journal of Production Economics, Canadian Journal of Chemical Engineering and several conference proceedings. He is a member of INFORMS and IIE.