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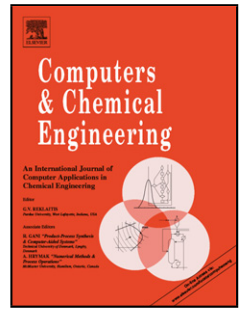

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Optimization Formulations for Multi-Product Supply Chain Networks

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Abstract

We present optimization formulations for multi-product supply chain networks. The formulations use a general graph representation that captures dependencies between an arbitrary number of products, technologies, and transportation paths. We discuss how to use the framework to compute compromise solutions that resolve geographical and stakeholder conflicts. We present case studies in which we seek to design supply chains to collect and process organic waste from a large number of farms in the State of Wisconsin to mitigate point phosphorus and methane emissions while minimizing investment and transportation costs.

Keywords: multi-product; graph; supply chain; priorities; multi-stakeholders; organic waste

1 Introduction

Multi-product supply chain networks involve a set of products that are transported to geographically dispersed facilities to be transformed into intermediate and final products that are delivered to final destinations. These models are used to identify optimal facility types, sizes, and locations (network design) as well as to identify optimal resource allocation strategies (network management/operation) [1–8]. Coupled infrastructure networks (e.g., gas, electric, water) as well as chemical supply chains are important application areas. The presence of *product transformations* is a key feature that distinguishes these models from those arising in other domains such as multi-commodity network flows [9].

The agricultural industry is an important application area of supply chain models. Models have been recently developed for biomass-to-fuels supply chains for the conversion of food crops to biodiesel [10–16], cellulosic biomass to biodiesel [17–26], cellulosic biomass to general biofuels [27–34], algae to biofuels [35], and biomass to energy [36–40]. Recent studies have also pointed out the need to model complex interactions over a wider range of products that include food, water, and energy resources [41, 42].