Invitation

You are cordially invited to the public defence to obtain the academic degree of

DOCTOR OF BUSINESS ECONOMICS

by Majid Yazdani

Exact solution methodologies for time-dependent non-linear systems: the financial optimization perspective

Supervisor:
Prof. dr. Tarik Aouam

Tuesday, 4 June 2024 at 15h
Please confirm your attendance no later than 20 May by email to Majid.Yazdani@ugent.be
and you will receive the link to follow the defense online.

EXAMINATION BOARD

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Abstract

In the field of operations research, dealing with time-dependent mixed integer nonlinear systems—a subset of combinatorial optimization problems—poses significant challenges due to dynamic parameters and complex relationships among its components. This complexity is especially pronounced in contexts like supply chain management and project scheduling, where discrete variables must be optimized within time-dependent constraints to avoid significant cost impacts on the system. To address these challenges effectively, combinatorial approaches incorporating decomposition strategies and approximation techniques are crucial. While single-tree and multitree methods are commonly used to solve Mixed Integer Nonlinear Programming problems, multitree and hybrid approaches are particularly effective, especially for convex MINLPs. However, specialized strategies such as piecewise linear approximations and convex relaxations are required for non-convex MINLPs, which are characterized by non-convex functions.

This thesis focuses on specific methods like Benders decomposition and approximation techniques, chosen for their effectiveness in managing large-scale systems and simplifying complex ones. These methods address challenges in two problem areas: optimizing multi-echelon inventory-transportation systems in maritime supply chains and solving the discrete time/cost trade-off problem in project scheduling. The dissertation categorizes these applications into three research streams: exact solution procedures for optimizing stochastic shipment planning and safety stock placement, and exact decomposition techniques for the discrete time/cost trade-off problems, project payment scheduling and financing cost distibution.

Chapter 2 explores maritime supply chain planning, investigating questions related to transportation optimization and safety stock placement. Chapter 3 addresses the discrete time/cost trade-off problem in project scheduling with net present value maximization, focusing on adapting models to real-world payment systems. Chapter 4 extends the model introduced in Chapter 3 by analyzing the joint perspective of the problem and its impact on project financing. Finally, Chapter 5 summarizes the contributions and outlines future directions for research.

This thesis bridges theoretical advancements with practical applications, offering interesting insights for decision-makers dealing with time-dependent nonlinear systems in combinatorial optimization. Both applications contribute to improving strategies for handling such systems, providing insights applicable to various decision problems.

Curriculum vitae

Majid Yazdani, born in Golpayegan, Iran, holds a Master's degree in Industrial Engineering with a specialization in Supply Chain Management, as well as a Bachelor's degree in Industrial Engineering with a focus on Production Management from Amirkabir University of Technology, Iran. He joined the Faculty of Economics and Business Administration at Ghent University in October 2020, where he serves as a research and teaching assistant for courses in Supply Chain Management and Advanced Production Management. Throughout his PhD, he presented research results at reputable conferences and seminars. Chapters 2 and 3 of his dissertation have already been published in top-quality journals, with the last chapter being a working paper scheduled for publication in a high-quality journal in the future. With over 10 years of dedicated experience in operations management, with a focus on supply chain planning, project management, and operations research, Majid brings industry-based expertise from his home country and recent academic experience at Ghent University. Proficient in modeling and analyzing optimization and operation scheduling challenges, he boasts a strong academic background and holds a CPIM certification.