FACULTY OF ENGINEERING AND ARCHITECTURE

Invitation to the public defense

Degradation-driven Spare Parts Inventory Control for Multi-Machine Systems with Lead Times Uncertainty

Naim Al Khoury

Thursday, April 30, 2026

GHENT UNIVERSITY

Supervisors

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Brief Curriculum Vitae

Naim Al Khoury is an engineer aiming at bridging the gap between industrial practice and academic research. He earned his bachelor's degree and master's degrees in mechanical engineering from the University of Balamand in Lebanon, in 2011 and 2012 respectively. Currently, he is a doctoral candidate in the Department of Industrial Systems Engineering and Product Design at Ghent University, Belgium.

Before transitioning to academia, Naim managed production and maintenance operations for a multinational manufacturing firm. This firsthand experience in the field allowed him to identify critical inefficiencies in manufacturing and supply chain processes.

Driven by these observations, his doctoral research employs data-driven modeling and simulation to optimize maintenance logistics in complex industrial systems. His work specifically focuses on spare parts decision-making for complex, multi-machine systems, while accounting for the inherent randomness in lead times.

His research has been published in leading academic journals and presented at several international and national conferences. In addition to his research activities, he contributes to teaching by supervising master's theses and leading exercise sessions in engineering courses.

When and where?

The public defense takes place on Thursday April 30, 2026, at 4:00 p.m. in the Lokaal 0.2, building Magnel, ground floor, Technologiepark-Zwijnaarde 60, 9052 Gent.

There will be a continuous reception, and you are warmly invited to attend.
Location: ISyE Meeting Room

Please confirm your attendance before April 20th via the following link: Naim Al Khoury PhD's Reception

The defense will also be livestreamed via Teams.
Meeting ID: 395 104 667 806 95
Passcode: 7w9AT2gM

Summary

Managing spare parts inventory is a critical challenge for service providers maintaining multi-machine systems, particularly under the uncertainty of replenishment lead times. While Condition-Based Maintenance provides predictive insights into future demand, effectively integrating these insights into inventory control remains an open question. This research addresses this challenge by developing data-driven spare parts policies for systems with multiple machines and stochastic lead times.

The study first introduces a Proactive Base Stock Policy, which leverages real-time degradation data to order spare parts, minimizing inventory levels while maintaining service requirements. By exploiting structural properties, an intelligent algorithm is developed to find its optimal parameters. This heuristic policy achieves significant savings compared to traditional policies that do not leverage data.

Given these potential savings, a development framework is established to enable benchmarking of policies from different methodologies. The problem is further extended to include inventory capacity constraints and batch ordering. Within this framework, the Proactive Base Stock Policy is adapted to operate under these realistic constraints.

Subsequently, the research develops advanced data-driven policies using three Deep Reinforcement Learning algorithms complemented by domain knowledge from existing policies. The results demonstrate that these DRL-based methods outperform traditional policies, scale to larger problem, and are explainable.

Contact

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