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Séminaire conjoint CIRRELT / Département OSD

ANAS NEUMANN, Chercheur postdoctoral
Université Laval et Polytechnique Montréal

SCHEDULING DESIGN AND MANUFACTURING OPERATIONS OF HIGHLY PERSONALIZED PROJECTS: HOW TO REDUCE THE RISKS OF WASTE AND INSTABILITY?

Abstract: The contemporary industrial market is characterized by intense competition and increasing expectations in terms of quality, customization, price, and lead times. This is also true in the off-site construction sector. Companies, and particularly SMEs, are compelled to continuously optimize the way they plan and execute their projects while seeking new market opportunities. In this context, customized engineer-to-order (ETO) projects offer SMEs a competitive advantage over industries with larger production capacities. However, the uncertain nature and partially unknown design of ETO projects make it even more challenging to predict costs and durations; lead to wastes of time, resources, and materials; reduce the robustness of proposed schedules; and increase the difficulty in predicting the performance of decisions made. Moreover, on a larger scale, current geopolitical, economic, and ecological realities drive a need for reindustrialization as well as an urgency to accelerate and digitalize construction projects. Through this research project, we propose EPS, an optimization model to schedule design and manufacturing operations of highly personalized projects. This model stands out for its flexibility: EPS considers a wide range of resources (including those related to outsourcing), objectives, and the key differences between physical (production, assembly) and non-physical operations (design and engineering). Besides, EPS integrates a proactive scheduling strategy designed to address the challenges mentioned above. Initially processed by a genetic algorithm, the EPS model is now solved via a hybrid approach, combining optimization and deep learning: a graph attention network trained with Multi-Agent Proximal Policy Optimization (MA-PPO). This approach enables leveraging past experiences to make decisions faster and with higher quality.

Biography: Anas Neumann is a researcher specializing in the application of deep learning, reinforcement learning, and heuristic optimization methods for solving decision-making problems. He holds a software engineering degree from the University of Manouba and earned a PhD in Operations and Decision Systems from Laval University in 2023. Conducted in collaboration with Genius ERP, his thesis focused on implementing a scheduling system for ETO projects. As a graduate student, he also participated in the design of an optimization model and a heuristic approach for the intelligent control of a welding robot from Alstom. As a postdoctoral fellow at Laval University, he develops data-driven prediction and recommendation models for the effective management of type 1 diabetes. This research project is conducted in collaboration with patients and physicians from the IRCM. At Polytechnique Montréal, he collaborates on a Franco-Canadian project and applies language and multi-modal models to Industry 4.0. Finally, he is the lead developer of www.i4evosim.com, a gamified simulation featuring a RAG assistant and used in the GSO-3105 course at ULaval.

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Pavillon Palasis-Prince
Salle 2327

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Responsable :
Jacques Renaud

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