

## Ph.D. Position in Industrial Engineering and Operations Research

**Topic:** Predictive and prescriptive analytics for production planning

**Institution:** IMT Atlantique, campus in Nantes, France  
LS2N-CNRS, team Logistics and Production Systems.

<https://www.imt-atlantique.fr/en>

**Supervisors:**

Prof. Dr. Alexandre Dolgui,

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Dr. Simon Thevenin,

Dr. Thomas Yeung.

**Keywords:** Production planning, Decision support, Digital twin, Optimization, Data analytics, Machine learning, Artificial Intelligence

IMT Atlantique is a top level French engineering school (Grande Ecole - a sort of technological university). It focuses on industrial engineering, digital technology, energy and the environment with the objectives of contributing to science and economic development through education, outstanding research and innovation. With more than 1000 publications each year (400 of which are A Rank), the research at IMT Atlantique is carried out by 290 permanent researchers and Faculty members, 110 non-permanent researchers and over 300 doctoral students.

The SLP (Logistics and Production Systems) team is part of the Optimization and Decision Support group of the Department of Automation, Production, and Computer Sciences. The team focuses on the design and optimization of production systems, logistic and transport networks, planning and scheduling of production activities, and risk management for industrial systems and services.

IMT Atlantique is seeking a PhD student to join the H2020 European funded ASSISTANT project. The ASSISTANT (LeArning and robuSt deciSIon SupporT sytems for agile mANufacTuring environments) consortium is composed of eleven academic teams from leading European Universities and industrial partners combining key skills in artificial intelligence, optimization, manufacturing, industrial engineering, edge computing and robotics. ASSISTANT aims to create intelligent digital twins through the joint use of machine learning (ML), optimization, simulation and domain models. The resulting tools will design and operate complex, collaborative, and reconfigurable production systems based on data collected from various sources such as IoT devices. ASSISTANT will experiment this methodology on a significant panel of use cases selected for their relevance in the current context of the digital transformation of production in major manufacturing sectors undergoing rapid transformation like energy, industrial equipment, and automotive sectors which already make extensive use of digital twins. ASSISTANT targets a significant increase in flexibility and reactivity,

product/process quality, and robustness of manufacturing systems by integrating human and machine intelligence in a sustainable learning relationship.

**Thesis description:**

Within the ASSISTANT project, this thesis aims to develop an intelligent digital twin for production planning to help production managers operate an agile factory. This twin extends advance planning systems with artificial intelligence and data analytics to take advantage of the massive amount of data generated on the shop floor and external data sources to yield better planning decisions. More specifically, it will be a decision support tool that helps production directors adjust the production capacity to demand (e.g., specifying the shop floor configuration, setting the worker requirements, subcontracting labor, setting the number of functional assembly lines, etc), and places orders of necessary components to the suppliers. This twin will yield robust decisions to hedge against various sources of uncertainties such as demand, production defects, process durations, etc.

*The work program includes:*

- Develop robust and stochastic optimization approach for lot-sizing models.
- Develop meta-heuristics to solve the resulting models.
- Develop machine learning approaches to learn the parameters of the models (costs, process durations, etc.) based on data and accurate simulation of the execution.
- Develop methods to estimate the parameters of the distribution (e.g., non-parametric Bayesian networks for learning them) and uncertainty sets.
- Validate the performance of the intelligent production planning twin by deploying the tool in the SIEMENS Energy plant in Berlin.

**Required skills:**

- Master/Engineer degree in Industrial engineering, Operations research, Artificial intelligence, Computer Science, or related technical fields.
- Knowledge of a programming language and a linear programming solver
- Strong English reading and writing skills.
- Knowledge in the one of the following topics would also be strongly appreciated: stochastic optimization, robust optimization, heuristics, machine learning, reinforcement learning.

**Start:** September - December 2020 (3 years PhD Program)

CV, letter of motivation, master grads, and recommendation letters must be sent to

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**Deadline:** July 5th, 2020.