

Proposal for a Postdoctoral research position

Dynamic predictive scheduling and line balancing in industry 4.0
« Ordonnancement et équilibrage de ligne prédictive dynamique pour l'industrie 4.0 »

Researched laboratory	LIRIS
Supervisor	Armand BABOLI, Associate professor, Habilitation
Starting and ending date	One year, renewable for an additional 6 months (18 months in total), Starting date: 1 May 2019
Funding	Scholarship internship (about 2000-2500 euro/month depending on your experiences)
Conditions for application	The candidate must to be a PhD in Industrial and System Engineering, Computer Engineering, or related filed
knowledge Requirements	Data science, Data analytics, Optimization, mathematical modelling, Operations Research,
Requested documents	CV (with detailed concerning the university course, work experience and internships), a cover letter describing background and motivation, ID card or Visa/resident card and 3 most relevant publications
Keywords	Industry 4.0, Production Planning and Scheduling, Line Balancing, Predictive approach, Data Analytics, Machine Learning, Artificial Intelligence,
General Context	<p>In the highly competitive world market, the traditional mass production system needs to move toward customized mass production. Moreover, for the best organization of this kind of system, it is necessary to have the real time information from production system and thus, connect all component of manufacturing system together (production equipment, transportation equipment, products and components, tools, etc.). This kind of system is called Industry 4.0, The Factory of the Future, Intelligent Manufacturing Systems (IMS), Cyber-Physical Systems (CPS), Smart Factory, etc.</p> <p>Such system is often presented as the fourth industrial revolution. In these systems, all objects (machines, operators, parts, products, etc.) are connected, together, generating a very large amount of data (Big Data) that will be supported by the Internet of Things in the world. One of the ideas for this system is to move from a centralized production model to a decentralized production model where materials and machines communicate with each other in real time without the need for a fixed production plan. In theory, this type of system must be able to self-diagnose, self-optimize and self-configure. However, the way to reach these goals is long and the challenges are very numerous. In practice, having an end-to-end connected production system via information and communication technologies (ICT), allows the integration of external information on logistics networks, incoming and outgoing production as well as marketing. This will involve closer cooperation between internal and external partners, such as producers, suppliers and customers.</p> <p>In order to address the above challenges, the Volvo Group has launched a transformation program called ‘GTO2.0’ (Group Trucks Operations 2.0). The objective of this program is to prepare and provide to all factories of the Group, the needed technological and methodological transformations towards Industry 4.0.</p> <p>This research subject concerns a part of research collaboration between VOLVO Group and INSA Lyon-LIRIS Laboratory.</p>

<p>Details of requested work for this internship</p>	<p>The main objective of this postdoctoral position is to study the problem and innovative solutions for Dynamic predictive scheduling and line balancing in the context of industry 4.0, based on reel time information and their possible application in the Volvo Group's factory. These solutions must not only take into account the constraint of assembly line, but also other constraints concerning part replenishment of line, kitting, sequencing of parts, transportation and replenishment of parts from external and internal suppliers (End to End Supply Chain). Some of these constraints are the hard constraints as respecting the available space in existing building, mix model assembly line principle, and some others can be modified, as external sequencing or internal kitting. The innovative solution must allow increasing the line First Time Through (FTT) for final assembly line where diesel and electric vehicle are assembled on a same production line.</p> <p>In the first step of this project, you will start by studying previous research on scheduling of assembly line and understanding their problem. A literature review on line balancing, scheduling and dynamic modification of these planned activity using real data and information come from shop floor. For example: dynamic decision, dynamic organization, dynamic line balancing, dynamic scheduling, etc. must be studied to a better understanding of subject and possible contribution.</p> <p>In a second step, focus will move to identification of main data and constraints in order to propose a new method or alternative solutions for line balancing and scheduling of a customize mass production. The main challenge for Customer mass production come from the variation of operation time from a product to the next one in the one hand, and several uncertainties (demand, capacities, delay, breakdown, etc.) on the other hand.</p> <p>The data and information concerning the products and production systems of several factories of Volvo group: the Blainville factory (Final Assembly line), other Volvo Groups components factories (engines, transmissions ...), and suppliers must be studied and analyzed. The methods come from data analytics (descriptive, predictive, prescriptive) have to be used.</p> <p>Finally, mathematical modeling and optimization, simulation and digital twin could be used to study the validity of the proposed solutions.</p>
<p>Specific Conditions</p>	<p>The postdoctoral researcher will work with Dr. Armand Baboli, in collaboration with our industrial partner, VOLVO. High level scientific publications are also sought during the post-doc period.</p> <p>In order to know about the manufacturing systems and their constraints, the interaction between these production systems and suppliers, their available data and information, you have to work with several managers. For this objective, some trips per month in France and Sweden will be organized. Full proficiency speaking in French and English is important.</p> <p>You must sign the confidentiality and non-disclosure agreement and you cannot communicate data and developed methods during and after your internship without our agreement.</p>
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