Sustainable smart scheduling in Industry 4.0

Highlights

• Development of sustainable smart scheduling system in Industry 4.0
• Development of mathematical model and efficient solution algorithms to solve the problem in short computation time
• Development of shop floor data, experimentation and validation of the developed algorithms

Overview

Over the last few years, manufacturing industries have witnessed the emergence of fourth generation industrial revolution (I4.0), which has shifted paradigm of manufacturing process based on Cyber-Physical Systems (CPS) to monitor physical processes, and make decentralized decisions by autonomous components connected via internet of things (IoT). By embedding smart decision making processes into these autonomous and decentralized manufacturing systems makes the future factories ‘smart’.

One of the main aspect of these smart decision making process is to alleviate issues with planning and scheduling tasks by applying advantages of I4.0 elements [1, 2].

This PhD project intends to investigate how manufacturing operation scheduling in I4.0 can contribute to efficiency and sustainability with regards to the environmental and economical dimensions. Scheduling plays a significant role in the production and it influences production efficiency, quality and cost and aims to optimize one or more [3]. In the context of sustainable manufacturing operations, two major important elements are: the input elements that enable the realization of a scheduling (man-machine, inventories, raw materials) and the output element that are consequences of the realization of the scheduling (hazard, waste, scrap, pollution) [4]. Thus, in a sustainable context, these elements are to be considered as decision variables when computing schedules in a predictive or reactive manner.

Scheduling in I4.0 requires efficient, dynamics and decentralized scheduling methods. The objective of this proposal is to study and develop mechanisms and intelligent algorithms to mitigate the problems induced by the real-time autonomous behavior of components in such a system. Innovative approaches and concepts such as cyber-physical systems, intelligent products, product-service systems to name a few can bring insights to the development of effective and efficient sustainable scheduling systems. The new configuration of scheduling framework and methodology in this PhD project aim at taking advantage of literature on traditional scheduling methodologies along
Methodology

The considered problems falls under operations managements and research. The emphasis of this research proposal is based on model-based quantitative research where models of casual relationships between control variables and performance variables are to be developed, simulated, analyzed, or implemented in practical environments. The research approach can be categorized into the deductive or the inductive approaches. This research can be divided into two main stages. In the first stage, a detailed literature review is carried out regarding existing scheduling problems, case studies, datasets, Industry 4.0 and sustainability approaches. Research will also focus on developing realistic shop floor data by analyzing problems arising in modern production systems of regional industries. The second stage forms the main part of this research, in which novel optimization models, heuristic and meta-heuristic approaches are developed. The developed solution methods are verified using case studies and developed datasets to check their performance. Finally, a detailed analysis of the results of the computational experiments is carried out and the efficient scheduling methodologies are implemented to verify their performances in practical manufacturing environments.

Further Reading


Funding

This research project is one of a number of projects in the Department. It is in competition for funding with one or more of these projects. Usually the project which receives the best applicant will be awarded the funding.

Home/EU Applicants

This project is eligible for a fully funded College of Science and Engineering studentship which includes:

- A full UK/EU fee waiver for 3.5 years
- An annual tax free stipend of £14,777 (2018/19)
- Research Training Support Grant (RTSG)

International Applicants

This project is eligible for a fully funded College of Science and Engineering studentship which includes:
Application Instructions

The online application and supporting documents are due by Monday 21st January 2019.

Any applications submitted after the deadline will not be accepted for the studentship scheme.

References should arrive no later than Monday 28th January 2019.

Applicants are advised to apply well in advance of the deadline, so that we can let you know if anything is missing from your application.

Required Materials

1. Online application form
2. Two academic references
3. Transcripts
4. Degree certificate/s (if awarded)
5. Curriculum Vitae
6. CSE Studentship Form
7. English language qualification

Applications which are not complete by the deadline will not be considered for the studentship scheme. It is the responsibility of the applicant to ensure the application form and documents are received by the relevant deadlines.

All applications must be submitted online, along with the supporting documents as per the instructions on the website.

Please ensure that all email addresses, for yourself and your referees, are correct on the application form.

For more information, please visit our website at:
https://www2.le.ac.uk/colleges/scieng/research/postgraduate-opportunities/cse-2019/instructions