# Editorial

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**Biographical notes:** Sabry Shaaban received his PhD in Management Science from Sheffield Hallam University (UK) and MSc in Operational Research from the University of Sussex (UK). He served as an Associate Professor at ESC Rennes (France) for the period 1999–2010. He is currently a Full Professor in the Department of Finance at ESC La Rochelle (France), where he teaches courses in operations management and management science. He has taught as a Visiting Professor at Thunderbird, Temple University, and other business schools overseas. His research interests include studying the performance of a wide variety of production lines.

## 1 Introduction

Despite the considerable amount of research that has been undertaken with the objective of furnishing operations managers and industrial engineers with effective production line design and operation rules, a great deal still remains to be learned.

The costs of setting up, running and maintaining production line systems worldwide are huge, so even slight improvements in line performance and efficiency can provide great advantages in the overall expenses.

Since most production lines suffer in practice from a certain degree of imbalance, it would make sense for production managers to examine the benefits of deliberately unbalancing their lines in the right direction.

This special *IJMTM* issue has the main aim of promoting and disseminating research that concentrates on unbalanced production line systems. It will present to academic researchers and practitioners the most recent findings and applications concerning the merits of this domain of investigation.

## 2 Organisation of the issue

A number of good quality paper manuscripts have been received from various authors. In total, seven submitted papers have been accepted for publication in this special *IJMTM* issue.

The first article (Meerkov and Zhang) is concerned with unbalanced production systems with floats, i.e., work-in-process built-up during the over-time, where the departments with lower throughput operate overtime to prevent starvation of those with

higher throughput. The authors study a system of two departments obeying the Bernoulli reliability model and offer a technique to calculate the smallest (lean) float capacity necessary to obtain a system throughput equal to that of the best department. Four design approaches are considered and it is shown that the ones based on transient analysis ensure superior performance.

In the second article, González-R et al. address the parameter setting problem in a specific card controlling mechanism (CCM), designed for conwip systems. They suggest an approach based on the response surface methodology and apply it to a five-station line. The results show that the performance of the CCM for the predicted values of parameters is very close to the optimal solution, obtaining savings of 82% in the number of simulations needed as compared to an exhaustive search of all possible parameter combinations.

The third contribution (Villalobas et al.) concentrates on analysing different work allocation strategies for serial assembly line designs, in order to determine which one performs the best under the presence of labour turnover and task-learning. In particular, the authors compare the traditional balanced line with two other designs: a variant of the bucket brigades (BB) and the modified work sharing (MWS) method, making use of control buffers and different levels of labour turnover. The results show that the MWS outperforms both the BB and balanced designs.

In the fourth article, Shaaban studies the behaviour and performance of unpaced production lines that are imbalanced with respect to both their operation time means and buffer sizes. The lines are simulated with various levels of line length, buffer capacity, degree of imbalance, and patterns of imbalance. In terms of idle time, it is found that the best unbalanced pattern is a mean processing time bowl configuration, coupled with an even distribution of buffer capacity. With respect to average buffer level, the best pattern turns out to be a monotone decreasing mean time order, together with an ascending buffer size arrangement.

Article five, authored by Al-Momani and Abu Qudeiri, investigates a parallel production system with rework path (PPS-RP) using genetic algorithm (GA), in order to find the nearest PPS-RP optimal design by optimising two decision variables: the buffer size between each pair of work stations and the machine numbers in each work station. A new GA simulation-based procedure, termed the non-homogeneous gene arrangement method, is introduced. An experimental numerical example shows that based on the new simulator, it was possible to get the nearest PPS-RP optimal design.

In paper six, McGovern and Gupta argue that the difference between a balanced disassembly line and an unbalanced system may be so insignificant that a focus purely on balance may obfuscate the benefits of considering other criteria. Therefore, metrics are also needed to evaluate the merits of all considered criteria; including the level of balance (or unbalance).The authors develop a multi-criteria benchmark data set and associated metrics for use in evaluating an unbalanced paced disassembly line. These data and metrics are then presented using an established disassembly line model and a deterministic, multi-criteria search heuristic.

Finally, in the last article (Areal et al.), two global heuristic optimisation methods, namely simulated annealing and GAs, are applied to the problem of finding the optimum sequence for unbalanced car assembly lines. Sequences have to be built according to vehicle's options, where each option requires different resources and production time. The paper also proposes a new cost function to better represent car scheduling constraints. The cost function and the optimisation methods have been found to be

efficient in the scheduling of real production for the highly flexible PSA Peugeot Citroën car assembly line at Vigo, Spain.

To conclude, it is hoped that such a thrilling experience will be beneficial to the readers of this issue. My sincere thanks are due to all the authors of the submitted papers for their genuine efforts to refine and improve their work. I wish also to thank the anonymous referees who provided useful, critical, but supportive assessments on the original drafts and suggested ways of enhancing the contents or presentations.