Minimizing Maximum Lateness for a No-Wait Flowshop Scheduling

Harun Aydilek
Mathematics & Natural Sciences Department
Gulf University for Science and Technology, Kuwait
aydilek.h@gust.edu.kw

Asiye Aydilek
Economics & Finance Department
Gulf University for Science and Technology, Kuwait
aydilek.a@gust.edu.kw

Muberra Allahverdi
Department of Mathematical Sciences
Kean University, New Jersey, USA.
muallahv@kean.edu

Ali Allahverdi
Industrial and Management Systems Engineering Department
Kuwait University, Kuwait
ali.allahverdi@ku.edu.kw

Abstract

We address a no-wait flow shop scheduling problem where the setup times are treated as separate and uncertain. The objective is to minimize maximum lateness which is one of the most essential performance measures for customer satisfaction and loss of goodwill. The considered problem is common in manufacturing environments like metal, food and pharmaceutical industries where some of the operations must not be interrupted. In many cases, setup time, the time required to set up a resource, is either ignored or assumed to be constant. However, these assumptions might lead to inefficient planning. Therefore, we relax these assumptions and consider uncertain but bounded setup times. The problem has been addressed in the scheduling literature where dominance relations were presented. In the current paper, we propose new dominance relations and show that the newly proposed dominance relations are around 100% more efficient than the existing. One of the main strengths of the newly proposed dominance relations is that their performances get better as the uncertainty in setup time increases. These dominance relations can also be used for initial sequence generation or improving the final solution as well as finding the optimal solutions for small size problems. Moreover, we also propose new and efficient heuristics as potential solutions for the problem and also for similar problems. Based on extensive computational experiments, we show that our new heuristics are around 90% more efficient than the existing ones in the literature under the same computational time.

Keywords
Heuristics, Flowshop scheduling, Dominance relations, Setup times and maximum lateness.

Biographies

Harun Aydilek is an Associate Professor of Applied Mathematics at Gulf University for Science and Technology, Kuwait. He received his B.S. in Mathematics from Bogazici University, Turkey and his MS in Mathematical Finance from University of Southern California, USA and also Ph.D. in Applied Mathematics from the same university. His

main research interest are scheduling, operations, research, mathematical modeling and mathematical economics. He has several papers in reputable journals.

Asiye Aydilek is an Associate Professor of Economics at Gulf University for Science and Technology, Kuwait. She received her B.S. in Computer Engineering from Bogazici University and her M.S. and Ph.D. in Economics from University of Southern California, USA. She has several publications in scheduling, operations, research and modelling with housing and wealth.

Muberra Allahverdi is an Assistant Professor Mathematics at Kean University. She received her B.S, M.S., and Ph.D. in Mathematics at the State University of New York, USA. Her main research interests are manufacturing and production scheduling, commutative algebra and algebraic statistics. She has several publications in the fields of operations research and algebra.

Ali Allahverdi is a Professor in the Department of Industrial and Management Systems Engineering of Kuwait University. He received his B.S. in Petroleum Engineering from Istanbul Technical University and his M.Sc. and Ph.D. in Industrial Engineering, from Rensselaer Polytechnic Institute, New York, USA. He worked for two years at Marmara University, Istanbul, Turkey, before joining Kuwait University in 1995. He received Distinguished Researcher Award in 2003 and 2015 from Kuwait University. He has been the editor of European Journal of Industrial Engineering since 2007 and served as guest editor for European Journal of Operations Research, International Journal of Production Research, and International Journal of Operations Research. He is currently serving as associate editor of several journals and on the editorial board of several other journals.