Journal of Mathematical Modelling and Algorithms in Operations Research
March 2013, Volume 12, Issue 1, pp 85-99

Minimizing the Number of Tardy Jobs in a Permutation Flowshop Scheduling Problem with Setup Times and Time Lags Constraints

Abstract

This paper studies the permutation flowshop scheduling problem with sequence dependent setup times and time lags constraints minimizing the number of tardy jobs. Dependent setup times are defined as the work to prepare the machines between two successive jobs. Time lags are defined as intervals of time that must exist between every couple of successive operations of the same job. Two mathematical programming formulations are proposed for the considered problem. A simulated annealing algorithm is also developed to solve the problem. Computational experiments are presented and discussed.

Related Content

References (24)

1. Allahverdi, A., Gupta, J.N.D., Aldowaisan, T.: A review of scheduling research involving setup considerations. OMEGA, Int. J. Manage. Sci. **27**, 219–239 (1999) CrossRef
2. Allahverdi, A., Al-Anzi, F.: Using two-machine flowshop with maximum lateness objective to model multimedia data objects scheduling problem for WWW applications. Comput. Oper. Res. **29**, 971–994 (2002) CrossRef
3. Allahverdi, A., Ng, C.T., Cheng, T.C.E., Kovalyov, M.Y.: A survey of scheduling problems with setup times or costs. Eur. J. Oper. Res. **187**, 985–1032 (2008) CrossRef
4. Brucker, P., Knust, S., Cheng, T.C.E., Shakhlevich, N.V.: Complexity results for flowshop and open shop scheduling problems with transportation delays. Ann. Oper. Res. **129**, 81–106 (2004) CrossRef
5. Bulfin, R.L., M'Hallah, R.: Minimizing the weighted number of tardy jobs on a two-machine flowshop. Comput. Oper. Res. **30**, 1887–1900 (2003) CrossRef
6. Corce, F.D., Gupta, J.N.D., Tadei, R.: Minimizing tardy jobs in a flowshop with common due date. Eur. J. Oper. Res. **120**, 375–381 (2000) CrossRef
7. Fondrevelle, J., Oulamara, A., Portmann, M-C.: Permutation flowshop scheduling problems with maximal and minimal time lags. Comput. Oper. Res. **33**, 1540–1556 (2006) CrossRef
8. Fondrevelle, J., Oulamara, A., Portmann, M.-C.: Permutation flowshop scheduling problems with time lags to minimize the weighted sum of machine completion times. Int. J. Prod. Econ. **112**, 168–176 (2008) CrossRef
9. Fortemps, Ph., Ost, Ch., Pirlot, M., Teghem, J., Tuyttens, D.: Using metaheuristics for solving a production scheduling problem in a chemical firm: a case study. Int. J. Prod. Econ. **46–47**, 13–26 (1996) CrossRef
10. Hariri, A.M.A., Potts, C.N.: A branch and bound algorithm to minimize the number of late jobs in a permutation flowshop. Eur. J. Oper. Res. **38**, 228–237 (1989) CrossRef
11. Johnson, S.M.: Optimal two-and-three-stage production schedules with setup times included. Nav. Res. Logist. Q. **1**, 61–68 (1954) CrossRef
12. Khurana, K., Bagga, P.C.: Minimizing the makespan in a two-machine fowshop with time lags and setup conditions. Z. Oper. Res. **28**, 163–174 (1984)
13. Kirkpatrick, S., Gelatt, J.C., Vecchi, M.: Optimisation by simulated annealing. Manage. Sci. **220**, 498–516 (1983)
14. Koulamas, C.: On the complexity of two-machine flowshop problems with due date related objectives. Eur. J. Oper. Res. **106**, 95–100 (1998) CrossRef
15. Lawler, E.L., Moore, J.M.: A functional equation and its application to resource allocation and sequencing problems. Manage. Sci. **15**, 102–109 (1968) CrossRef
16. Moore, J.M.: An n job, one machine algorithm for minimizing the number of late jobs. Manage. Sci. **15**, 102–109 (1968) CrossRef
17. Munier-Kordon, A., Rebaine, D.: Polynomial time algorithms for the UET permutation flowshop problem with time delays. Comput. Oper. Res. **35**, 525–537 (2008) CrossRef
18. Parthasarathy, S., Rajendran, C.: An experimental evaluation of heuristics for scheduling in a real-life flowshop with sequence dependent setup times of jobs. Int. J. Prod. Econ. **49**, 255–263 (1997) CrossRef
19. Rios-Mercado, R.Z., Bard, J.F.: Computational Experience with a branch-and-cut algorithm for flowshop scheduling with setups. Comput. Oper. Res. **25**, 351–366 (1998) CrossRef
20. Ruiz, R., Maroto, C., Alcaraz, J.: Solving the flowshop scheduling problem with sequence dependent setup times using advanced

metaheuristics. Eur. J. Oper. Res. **165**, 34–54 (2005) CrossRef

21. Stafford, E.F., Tseng, F.T.: Two models for a family of flowshop sequencing problems. Eur. J. Oper. Res. **142**, 282–293 (2002) CrossRef
22. Szwarc, W.: The flowshop problem with time lags and separated setup times. ZOR-Z. Oper. Res. **30**, 15–22 (1986)
23. Teghem, J., Pirlot, M.: Optimisation Approchée en Recherche Opérationnelle. Hermes Science Publications, Paris (2002)
24. Yang, D.L., Chern, M.S.: A two-machine flowshop sequencing problem with limited waiting time constraints. Comput. Ind. Eng. **28**, 63–70 (1995) CrossRef

About this Article

Title
Minimizing the Number of Tardy Jobs in a Permutation Flowshop Scheduling Problem with Setup Times and Time Lags Constraints
Journal
Journal of Mathematical Modelling and Algorithms in Operations Research
Volume 12, Issue 1 , pp 85-99

Cover Date
2013-03-01
DOI
10.1007/s10852-012-9180-x
Print ISSN
1570-1166
Online ISSN
1572-9214
Publisher
Springer Netherlands
Additional Links

- Register for Journal Updates
- Editorial Board
- About This Journal
- Manuscript Submission

Topics

- Operations Research, Management Science
- Mathematical Modeling and Industrial Mathematics
- Optimization
- Numeric Computing
- Algorithms

Keywords

- Permutation flowshop
- Setup times
- Time lags
- Mathematical programming
- Simulated annealing

Authors

- Emna Dhouib [1]

- Jacques Teghem [2]
- Taïcir Loukil [1]

Author Affiliations

- 1. Unité de recherche LOgistique Gestion Industrielle et de la Qualité (LOGIQ), Université de Sfax, Institut Supérieur de Gestion Industrielle de Sfax, Route el Mharza km 1.5, 3018, Sfax, Tunisie
- 2. Service de Mathématique et de Recherche Opérationnelle (MathRO), Université de Mons /Faculté Polytechnique de Mons, 21, Place du Parc, 7000, Mons, Belgique