



# Inspired Nature Meta-Heuristics Minimizing Total Tardiness for Manufacturing Flow Shop Scheduling under Setup Time Constraint

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**Abstract.** The study of the variant under machine unavailability and setup time constraints is of great industrial importance. In this paper, we present an optimization of manufacturing flow shop scheduling under setup time constraints. The objective is to minimize the total tardiness for a set of jobs with deadline times to respect. This intention is aimed at satisfying customer requirements and gaining their trust. To investigate this problem, we applied three inspired-nature meta-heuristics: the artificial bee colony algorithm, the genetic technique algorithm and finally the migratory bird optimization algorithm. A set of numerical simulations on a variety of instances is suggested to check the efficiency and strength of our algorithms. The results obtained show the strong success of the migratory bird optimization algorithm compared to other algorithms.

**Keywords:** Inspired nature metaheuristics - Manufacturing flow shop - Optimization - Sequence dependent setup time - Total tardiness

## 1 Introduction

The manufacturing flow shop scheduling (MFSS) optimization problem is widely present in several industries. In real industrial cases, manufacturing machines require prior tuning before processing a new job. This constraint has become prevalent in varieties of production machines. When a job requires a setup time dependent on its successor, this induces the sequence-dependent setup time (SDST) constraint. In this contribution, we study the MFSS\_SDST issue to reduce the total tardiness (TT) criterion. Production managers are constrained to satisfy customer demands while respecting a delay ( $d_j$ ) of one job or job batch.  $Fm|SDST, prmu, dj|TT$  with respect to the notation adopted in the literature scheduling optimization area, will denote this problem. The first field  $\alpha$  represents the manufacturing flow shop with  $Fm$  serial machines, the second field  $\beta$  designates the constraints:  $prmu$ ,  $SDST$ ,  $d_j$  and the third field  $\gamma$  identifies the criterion to be minimized. The MFSS flow shop problem [1–3] has been the subject of many

# Meta Heuristics For Large Scale Process Scheduling

**F. G. Filip, I. Dumitrache, S. S. Iliescu**



## **Meta Heuristics For Large Scale Process Scheduling:**

**Applications of Metaheuristics in Process Engineering** Jayaraman Valadi, Patrick Siarry, 2014-08-07 Metaheuristics exhibit desirable properties like simplicity easy parallelizability and ready applicability to different types of optimization problems such as real parameter optimization combinatorial optimization and mixed integer optimization They are thus beginning to play a key role in different industrially important process engineering applications among them the synthesis of heat and mass exchange equipment synthesis of distillation columns and static and dynamic optimization of chemical and bioreactors This book explains cutting edge research techniques in related computational intelligence domains and their applications in real world process engineering It will be of interest to industrial practitioners and research academics

Metaheuristics for Scheduling in Distributed Computing Environments Fatos Xhafa, Ajith Abraham, 2008-09-08 Grid computing has emerged as one of the most promising computing paradigms of the new millennium Achieving high performance Grid computing requires techniques to efficiently and adaptively allocate jobs and applications to available resources in a large scale highly heterogeneous and dynamic environment This volume presents meta heuristic approaches for Grid scheduling problems Due to the complex nature of the problem meta heuristics are primary techniques for the design and implementation of efficient Grid schedulers The volume brings new ideas analysis implementations and evaluation of meta heuristic techniques for Grid scheduling which make this volume novel in several aspects The 14 chapters of this volume have identified several important formulations of the problem which we believe will serve as a reference for the researchers in the Grid computing community Important features include the detailed overview of the various novel metaheuristic scheduling approaches excellent coverage of timely advanced scheduling topics state of the art theoretical research and application developments and chapters authored by pioneers in the field Academics scientists as well as engineers engaged in research development and scheduling will find the comprehensive coverage of this book invaluable

*Artificial Intelligence and Sustainable Innovation* Arvind Dagur, Sohit Agarwal, Dharendra Kumar Shukla, Shabir Ali, Sandhya Sharma, 2026-01-06 This book brings together researchers academicians industry professionals and policymakers to explore the transformative role of Artificial Intelligence AI in addressing global sustainability challenges With a distinct focus on the United Nations Sustainable Development Goals SDGs it serves as a rich repository of research on AI for energy efficiency climate change mitigation smart cities healthcare and education This title comprises a selection of papers that reflect an emphasis on interdisciplinary research and real world applications It covers a broad spectrum of topics including but not limited to Artificial Intelligence and Sustainable Innovation in green infrastructure industry and manufacturing education and policy banking navigation communication security and sustainable agriculture It also delves into real life applications of intelligent computing and communication techniques in congruence with SDG goals Researchers academicians research scholars persons in industry students entrepreneurs and technology enthusiasts will benefit from this

book *Large Scale Systems* F. G. Filip, I. Dumitrache, S. S. Iliescu, 2002 This volume contains the papers presented at the 9th IFAC Symposium on Large Scale Systems Theory and Applications LSS 2001 held in Bucharest Romania 18-20 July 2001 Its aim was to address the control aspects of those industrial economic social and environmental systems whose characteristics are high dimensionality non linearity and uncertainty associated with a multitude of structural forms with intense and time critical information exchange and efficient co ordination The symposium covered all major aspects of large scale complex systems including methodological aspects technological solutions and practical applications methodological aspects and those devoted to practical applications Several invited sessions were organised including papers from leading world experts The papers are ordered in accordance with the technical sessions Session topics include methodology and application fields traditional to this Symposium series Topics covered include the following modelling and model reduction decentralized control and estimation hierarchical control intelligent and fuzzy control nonlinear dynamics in complex systems complex systems theory and analysis water gas power systems large scale CIMs and production planning and scheduling communication and information systems transportation systems modelling and control of wastewater treatment plants and societal systems modelling planning and management technical programme such as decision support systems and risk and governance in large scale systems More recent issues such as risk management and human decision in large scale systems were well received by the symposium participants and provide an extra dimension to volume

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**Metaheuristics** Siddhartha Bhattacharyya, Hiranmoy Roy, Jan Platos, Leo Mršić, Balamurugan Balusamy, 2026-01-23

Multilevel Quantum Metaheuristics Applications in Data Exploration explores the most recent advances in hybrid quantum inspired algorithms Combining principles of quantum mechanics with metaheuristic techniques for efficient data optimization this book examines multilevel quantum systems characterized by qudits and higher level quantum states as more robust alternatives to conventional bilevel quantum approaches It introduces novel multilevel applications of quantum metaheuristics for addressing optimization problems in areas including function optimization data analysis scheduling and signal processing The book also showcases real world examples case studies and contributions that emphasize the effectiveness of proposed multilevel techniques over existing bilevel methods Researchers professionals and engineers working on intelligent computing quantum computing data processing clustering and analysis and those interested in the synergies between quantum computing metaheuristics and multilevel quantum systems for enhanced data exploration and analysis will find this book to be of great value Provides insights into the future of quantum inspired optimization by covering recent trends and mathematical techniques Advances knowledge of evolving time efficient hybrid quantum algorithms that leverage the processing capabilities of emerging qudit based paradigms Presents in depth analysis of quantum mechanical principles with special reference to multilevel quantum states

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**Meta-Heuristics Approaches** Jiuping Xu, Mitsuo Gen, Zongmin Li, YoungSu Yun, 2023-12-22 This book introduces and

analyses recent trends and studies of sustainable logistics systems using AI based meta heuristics approaches including AI based meta heuristics applied to supply chain network models integrated multi criteria decision making approaches for green supply chain management uncertain supply chain models etc It emphasizes both theory and practice providing methodological and theoretical basis as well as case references for sustainable logistics systems using AI based meta heuristics Most of multi national enterprises today face the challenge of sustainable development for their logistics systems trying to meet or exceed customer expectations Sustainable development attracts both researchers and industrial practitioners who are focused on the design and implementation of logistics system AI based meta heuristics approaches has emerged as a capable method for quickly providing optimal or near optimal solutions for the problems that exact optimization cannot solve Recent advances in various AI based meta heuristics approaches can resolve various and complex logistics and supply chain problem types This book mainly encompasses the most popular and frequently employed AI based meta heuristics approaches such as genetic algorithm variable neighborhood search multi objective heuristic search and the hybrid of these approaches The chapters in this book were originally published in the International Journal of Management Science and Engineering Management

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Fatos Xhafa,2008-08-19 This volume presents meta heuristics approaches for Grid scheduling problems It brings new ideas analysis implementations and evaluation of meta heuristic techniques for Grid scheduling which make this volume novel in several aspects

#### Metaheuristics for Production Scheduling Bassem Jarboui,Patrick Siarry,Jacques Teghem,2013-06-12

This book describes the potentialities of metaheuristics for solving production scheduling problems and the relationship between these two fields For the past several years there has been an increasing interest in using metaheuristic methods to solve scheduling problems The main reasons for this are that such problems are generally hard to solve to optimality as well as the fact that metaheuristics provide very good solutions in a reasonable time The first part of the book presents eight applications of metaheuristics for solving various mono objective scheduling problems The second part is itself split into two the first section being devoted to five multi objective problems to which metaheuristics are adapted while the second tackles various transportation problems related to the organization of production systems Many real world applications are presented by the authors making this an invaluable resource for researchers and students in engineering economics mathematics and computer science

#### **Encyclopedia of Optimization** Christodoulos A. Floudas,Panos M.

Pardalos,2008-09-04 The goal of the Encyclopedia of Optimization is to introduce the reader to a complete set of topics that show the spectrum of research the richness of ideas and the breadth of applications that has come from this field The second edition builds on the success of the former edition with more than 150 completely new entries designed to ensure that the reference addresses recent areas where optimization theories and techniques have advanced Particularly heavy attention resulted in health science and transportation with entries such as Algorithms for Genomics Optimization and Radiotherapy

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**in Process Industry** , HKUST Call Number Thesis CENG 2007 He **Metaheuristics in Combinatorial Optimization**  
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