

# Development of meta-heuristics for workflow scheduling based on quality of service requirements

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# Meta Heuristics For Large Scale Process Scheduling

**Fatos Xhafa, Ajith Abraham**



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

**Integrating meta-heuristics and a Sarsa algorithm for disassembly scheduling problems with cycle time and hazard coefficients** Dachao Li, Kaizhou Gao, Yaxian Ren, Ruixue Zhang, Yaping Fu, 2024-01-29 End of life products recycling can reduce the waste of resources and disassembly line scheduling planning can effectively improve the recycling efficiency and reduce the pollution of the environment This work addresses a bi objective disassembly line scheduling problem with considering time interference between tasks The weighted sum of the cycle time and hazard coefficients is optimized First a mathematical model of the disassembly line scheduling problem is established under the constraints of priority and time interference relationships Second four meta heuristics are improved to solve the concerned problems including particle swarm optimization artificial bee colony genetic algorithm and variable neighborhood search Ten objective oriented local search operations are designed for improving meta heuristics performance A reinforcement learning algorithm Sarsa is employed to guide task assignment among workstations and local search selection during iterations respectively Finally experiments are carried out for 10 instances with different scales The effectiveness of the improving strategies is verified the meta heuristics combined with Sarsa based task assignment and local search strategies has better robustness and stability than the classical ones Comparisons and discussions show that the particle swarm optimization with improved strategies outperforms other algorithms

**Metaheuristics for Scheduling in Industrial and Manufacturing Applications** Fatos Khafa, Ajith Abraham, 2008-06-21 During the past decades scheduling has been among the most studied optimization problems and it is still an active area of research Scheduling appears in many areas of science engineering and industry and takes different forms depending on the restrictions and optimization criteria of the operating environments 8 For instance in optimization and computer science scheduling has been defined as the allocation of tasks to resources over time in order to achieve optimality in one or more objective criteria in an efficient way and in production as production schedule i.e. the planning of the production or the sequence of operations according to which jobs pass through machines and is optimal with respect to certain optimization criteria Although there is a standardized form of stating any scheduling problem namely efficient allocation of jobs on machines which can process no more than one activity at a time with the objective to optimize some objective function of the job completion times scheduling is in fact a family of problems Indeed several parameters intervene in the problem definition a job characteristics preemptive or not precedence constraints release dates etc b resource environment single vs parallel machines unrelated machines identical or uniform machines etc c optimization criteria minimize total tardiness the number of late jobs makespan overtime etc maximize resource utilization etc and d scheduling environment static vs dynamic in the former the number of jobs to be considered and their ready times are available while in the latter the number of jobs and their characteristics change over time

**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

*Optimization Methods in Manufacturing Processes* Anand J. Kulkarni, 2025-08-05 This book presents the result of an innovative challenge to create a systematic literature overview driven by machine generated content Questions and related keywords were prepared for the machine to query discover collate and structure by Artificial Intelligence AI clustering The AI based approach seemed especially suitable to provide an innovative perspective as the topics are indeed both complex interdisciplinary and multidisciplinary for example climate planetary and evolution sciences Springer Nature has published much on these topics in its journals over the years so the challenge was for the machine to identify the most relevant content and present it in a structured way that the reader would find useful The automatically generated literature summaries in this book are intended as a springboard to further discoverability They are particularly useful to readers with limited time looking to learn more about the subject quickly and especially if they are new to the topics Springer Nature seeks to support anyone who needs a fast and effective start in their content discovery journey from the undergraduate student exploring interdisciplinary content to Master or PhD thesis developing research questions to the practitioner seeking support materials this book can serve as an inspiration to name a few examples It is important to us as a publisher to make the advances in technology easily accessible to our authors and find new ways of AI based author services that allow human machine interaction to generate readable usable collated research content

**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

*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

**Handbook of Approximation Algorithms and Metaheuristics** Teofilo F. Gonzalez, 2007-05-15 Delineating the tremendous growth in this area the Handbook of Approximation Algorithms and Metaheuristics covers fundamental theoretical topics as well as advanced practical applications It is the first book to comprehensively study both approximation algorithms and metaheuristics Starting with basic approaches the handbook presents the methodologies to design and analyze efficient approximation algorithms for a large class of problems and to establish inapproximability results for another class of problems It also discusses local search neural networks and metaheuristics as well as multiobjective problems sensitivity analysis and stability After laying this foundation the book applies the methodologies to classical problems in combinatorial optimization computational geometry and graph problems In addition it explores large scale and emerging applications in networks bioinformatics VLSI game theory and data analysis Undoubtedly sparking further developments in the field this handbook provides the essential techniques to apply approximation algorithms and metaheuristics to a wide range of problems in computer science operations research computer engineering and economics Armed with this information researchers can design and analyze efficient algorithms to generate near optimal solutions for a wide range of computational intractable problems

**Distributed Computing and Artificial Intelligence, 11th International Conference** Sigeru Omatu, Hugues Bersini, Juan M. Corchado, Sara Rodríguez, Paweł Pawlewski, Edgardo Bucciarelli, 2014-05-30 The 11th International Symposium on Distributed Computing and Artificial Intelligence 2014 DCAI 2014 is a forum to present applications of innovative techniques for studying and solving complex problems The exchange of ideas between scientists and technicians from both the academic and industrial sector is essential to facilitate the development of systems that can meet the ever increasing demands of today's society The present edition brings together past experience current work and promising future trends associated with distributed computing artificial intelligence and their application in order to provide efficient solutions to real problems This year's technical program presents both high

quality and diversity with contributions in well established and evolving areas of research Algeria Brazil China Croatia Czech Republic Denmark France Germany Ireland Italy Japan Malaysia Mexico Poland Portugal Republic of Korea Spain Taiwan Tunisia Ukraine United Kingdom representing a truly wide area network of research activity DCAI 14 Special Sessions have been a very useful tool in order to complement the regular program with new or emerging topics of particular interest to the participating community Special Sessions that emphasize on multi disciplinary and transversal aspects such as AI driven methods for Multimodal Networks and Processes Modeling and Multi Agents Macroeconomics have been especially encouraged and welcome This symposium is organized by the Bioinformatics Intelligent System and Educational Technology Research Group <http://bisite.usal.es> of the University of Salamanca The present edition was held in Salamanca Spain from 4th to 6th June 2014

**Metaheuristics** Luca Di Gaspero, Paola Festa, Amir Nakib, Mario Pavone, 2023-02-22 This book constitutes the refereed proceedings of the 14th International Conference on Metaheuristics MIC 2022 held in Syracuse Italy in July 2022 The 48 full papers together with 17 short papers presented were carefully reviewed and selected from 72 submissions The papers detail metaheuristic techniques Chapter Evaluating the Effects of Chaos in Variable Neighbourhood Search is available open access under a Creative Commons Attribution 4.0 International License via [link.springer.com](https://link.springer.com)

Application of Advanced Optimization Techniques for Healthcare Analytics Mohamed Abdel-Basset, Ripon K.

Chakraborty, Reda Mohamed, 2023-04-11 Application of Advanced Optimization Techniques for Healthcare Analytics 1st Edition is an excellent compilation of current and advanced optimization techniques which can readily be applied to solve different hospital management problems The healthcare system is currently a topic of significant investigation to make life easier for those who are disabled old or sick as well as for young children The emphasis of the healthcare system has evolved throughout time due to several emerging beneficial technologies such as personal digital assistants PDAs data mining the internet of things metaheuristics fog computing and cloud computing Metaheuristics are strong technology for tackling several optimization problems in various fields especially healthcare systems The primary advantage of metaheuristic algorithms is their ability to find a better solution to a healthcare problem and their ability to consume as little time as possible In addition metaheuristics are more flexible compared to several other optimization techniques These algorithms are not related to a specific optimization problem but could be applied to any optimization problem by making some small adaptations to become suitable to tackle it The successful outcome of this book will enable a decision maker or practitioner to pick a suitable optimization approach when making decisions to schedule patients under crowding environments with minimized human errors

**Proceedings of the 6th International Conference on Big Data and Internet of Things**

Mohamed Lazaar, El Mokhtar En-Naimi, Abdelhamid Zouhair, Mohammed Al Achhab, Oussama Mahboub, 2023-03-28 This book is a collection of papers that were presented at the 6th International Conference on Big Data Cloud and Internet of Things BDIoT 2022 The conference took place on October 25-27 2022 Tangier Morocco The book consisted of 49 chapters which

correspond to the four major areas that are covered during the conference namely Big Data Cloud Computing Cybersecurity Machine Learning Deep Learning E Learning Internet of Things Information System and Natural Language Processing Every year BDIoT attracted researchers from all over the world and this year was not an exception the authors received 98 submissions from 7 countries More importantly there were participants from many countries which indicates that the conference is truly gaining more and more international recognition as it brought together a vast number of specialists who represented the aforementioned fields and share information about their newest projects Since the authors strived to make the conference presentations and proceedings of the highest quality possible the authors only accepted papers that presented the results of various investigations directed to the discovery of new scientific knowledge in the area of Big Data IoT and their applications All the papers were reviewed and selected by the Program Committee which comprised 96 reviewers from over 58 academic institutions As usual each submission was reviewed following a double process by at least two reviewers When necessary some of the papers were reviewed by three or four reviewers Authors deepest thanks and appreciation go to all the reviewers for devoting their precious time to produce truly through reviews and feedback to the authors

**Recent Advances on Meta-Heuristics and Their Application to Real Scenarios** Javier Del Ser

Lorente,2013-01-30 This book aims at attracting the interest of researchers and practitioners around the applicability of meta heuristic algorithms to practical scenarios arising from different knowledge disciplines Emphasis is placed on evolutionary algorithms and swarm intelligence as computational means to efficiently balance the tradeoff between optimality of the produced solutions and the complexity derived from their estimation In summary this book serves as a good start point for early stage investigators in the initial steps of their research on meta heuristics grounded on both a thorough literature review and the practical orientation of its contents

**14th International Symposium on Process Systems Engineering**

Yoshiyuki Yamashita,Manabu Kano,2022-06-24 14th International Symposium on Process Systems Engineering Volume 49 brings together the international community of researchers and engineers interested in computing based methods in process engineering The conference highlights the contributions of the PSE community towards the sustainability of modern society and is based on the 2021 event held in Tokyo Japan July 1 23 2021 It contains contributions from academia and industry establishing the core products of PSE defining the new and changing scope of our results and covering future challenges Plenary and keynote lectures discuss real world challenges globalization energy environment and health and contribute to discussions on the widening scope of PSE versus the consolidation of the core topics of PSE Highlights how the Process Systems Engineering community contributes to the sustainability of modern society Establishes the core products of Process Systems Engineering Defines the future challenges of Process Systems Engineering

*Handbook of Metaheuristics* Fred W. Glover,Gary A. Kochenberger,2006-04-11 Metaheuristics in their original definition are solution methods that orchestrate an interaction between local improvement procedures and higher level strategies to create a process capable of escaping from

local optima and performing a robust search of a solution space Over time these methods have also come to include any procedures that employ strategies for overcoming the trap of local optimality in complex solution spaces especially those procedures that utilize one or more neighborhood structures as a means of defining admissible moves to transition from one solution to another or to build or destroy solutions in constructive and destructive processes The degree to which neighborhoods are exploited varies according to the type of procedure In the case of certain population based procedures such as genetic algorithms neighborhoods are implicitly and somewhat restrictively defined by reference to replacing components of one solution with those of another by variously chosen rules of exchange popularly given the name of crossover In other population based methods based on the notion of path relinking neighborhood structures are used in their full generality including constructive and destructive neighborhoods as well as those for transitioning between complete solutions Certain hybrids of classical evolutionary approaches which link them with local search also use neighborhood structures more fully though apart from the combination process itself

**Industry 4.0 and Hyper-Customized Smart Manufacturing Supply Chains** Ponnambalam, S.G., Subramanian, Nachiappan, Tiwari, Manoj Kumar, Wan Yusoff, Wan Azhar, 2019-06-28 Next generation supply chains revolve around smart manufacturing processes and personalized customization of products and services For businesses to stay relevant in the market today prioritizing customer satisfaction with speed and great service has become crucial Industry 4.0 and Hyper Customized Smart Manufacturing Supply Chains is an assemblage of innovative research ideas surrounding the methods of modern smart manufacturing technologies and digital supply chain management in the era of Industry 4.0 While highlighting topics including blockchain diffusion logistics system and data analytics this book is ideally designed for industry professionals researchers managers and students seeking current research on the role of technology in business production

*Intelligent Computing Theories and Application* De-Shuang Huang, Kang-Hyun Jo, Xiao-Long Zhang, 2018-08-08 This two volume set LNCS 10954 and LNCS 10955 constitutes in conjunction with the volume LNAI 10956 the refereed proceedings of the 14th International Conference on Intelligent Computing ICIC 2018 held in Wuhan China in August 2018 The 275 full papers and 72 short papers of the three proceedings volumes were carefully reviewed and selected from 632 submissions The papers are organized in topical sections such as Neural Networks Pattern Recognition Image Processing Intelligent Computing in Robotics Intelligent Control and Automation Intelligent Data Analysis and Prediction Fuzzy Theory and Algorithms Supervised Learning Unsupervised Learning Kernel Methods and Supporting Vector Machines Knowledge Discovery and Data Mining Natural Language Processing and Computational Linguistics Gene Expression Array Analysis Systems Biology Computational Genomics Computational Proteomics Gene Regulation Modeling and Analysis Protein Protein Interaction Prediction Next Gen Sequencing and Metagenomics Structure Prediction and Folding Evolutionary Optimization for Scheduling High Throughput Biomedical Data Integration and Mining Machine Learning Algorithms and Applications Heuristic Optimization Algorithms



for Real World Applications Evolutionary Multi Objective Optimization and Its Applications Swarm Evolutionary Algorithms for Scheduling and Combinatorial Optimization Swarm Intelligence and Applications in Combinatorial Optimization Advances in Metaheuristic Optimization Algorithm Advances in Image Processing and Pattern Recognition Techniques AI in Biomedicine Bioinformatics Biometrics Recognition Information Security Virtual Reality and Human Computer Interaction Healthcare Informatics Theory and Methods Intelligent Computing in Computer Vision Intelligent Agent and Web Applications Reinforcement Learning Machine Learning Modeling Simulation and Optimization of Biological Systems Biomedical Data Modeling and Mining Cheminformatics Intelligent Computing in Computational Biology Protein Structure and Function Prediction Biomarker Discovery Hybrid Computational Intelligence Theory and Application in Bioinformatics Computational Biology and Systems Biology IoT and Smart Data Intelligent Systems and Applications for Bioengineering Evolutionary Optimization Foundations and Its Applications to Intelligent Data Analytics Protein and Gene Bioinformatics Analysis Algorithms and Applications      Constraint Programming and Large Scale Discrete Optimization Eugene C.

Freuder, Richard John Wallace, 2001-01-01 Constraint programming has become an important general approach for solving hard combinatorial problems that occur in a number of application domains such as scheduling and configuration This volume contains selected papers from the workshop on Constraint Programming and Large Scale Discrete Optimization held at DIMACS It gives a sense of state of the art research in this field touching on many of the important issues that are emerging and giving an idea of the major current trends Topics include new strategies for local search multithreaded constraint programming specialized constraints that enhance consistency processing fuzzy representations hybrid approaches involving both constraint programming and integer programming and applications to scheduling problems in domains such as sports scheduling and satellite scheduling      Fuzzy Information and Engineering Bing-Yuan Cao, 2007-07-07 The Second International Conference on Fuzzy Information and Engineering ICFIE2007 is a major symposium for scientists engineers and practitioners in China as well as the world to present their latest results ideas developments and applications in all areas of fuzzy information and knowledge engineering It aims to strengthen relations between industry research laboratories and universities and to create a primary symposium for world scientists

**Evolutionary Based Solutions for Green Computing** Samee Ullah Khan, Joanna Kołodziej, Juan Li, Albert Y. Zomaya, 2012-08-14 Today s highly parameterized large scale distributed computing systems may be composed of a large number of various components computers databases etc and must provide a wide range of services The users of such systems located at different geographical or managerial network cluster may have a limited access to the system s services and resources and different often conflicting expectations and requirements Moreover the information and data processed in such dynamic environments may be incomplete imprecise fragmentary and overloading All of the above mentioned issues require some intelligent scalable methodologies for the management of the whole complex structure which unfortunately

may increase the energy consumption of such systems An optimal energy utilization has reached to a point that many information technology IT managers and corporate executives are all up in arms to identify scalable solution that can reduce electricity consumption so that the total cost of operation is minimized of their respective large scale computing systems and simultaneously improve upon or maintain the current throughput of the system This book in its eight chapters addresses the fundamental issues related to the energy usage and the optimal low cost system design in high performance green computing systems The recent evolutionary and general metaheuristic based solutions for energy optimization in data processing scheduling resource allocation and communication in modern computational grids cloud and network computing are presented along with several important conventional technologies to cover the hot topics from the fundamental theory of the green computing concept and to describe the basic architectures of systems This book points out the potential application areas and provides detailed examples of application case studies in low energy computational systems The development trends and open research issues are also outlined All of those technologies have formed the foundation for the green computing that we know of today

*Metaheuristic and Machine Learning Optimization Strategies for Complex Systems* R., Thanigaivelan, M., Suchithra, S., Kaliappan, Mothilal, T., 2024-07-17 In contemporary engineering domains optimization and decision making issues are crucial Given the vast amounts of available data processing times and memory usage can be substantial Developing and implementing novel heuristic algorithms is time consuming yet even minor improvements in solutions can significantly reduce computational costs In such scenarios the creation of heuristics and metaheuristic algorithms has proven advantageous The convergence of machine learning and metaheuristic algorithms offers a promising approach to address these challenges *Metaheuristic and Machine Learning Optimization Strategies for Complex Systems* covers all areas of comprehensive information about hyper heuristic models hybrid meta heuristic models nature inspired computing models and meta heuristic models The key contribution of this book is the construction of a hyper heuristic approach for any general problem domain from a meta heuristic algorithm Covering topics such as cloud computing internet of things and performance evaluation this book is an essential resource for researchers postgraduate students educators data scientists machine learning engineers software developers and engineers policy makers and more

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