

Solving Job Shop Scheduling Problem Using An Ant Colony

Computer solutions to many difficult problems in science and engineering require the use of automatic search methods that consider a large number of possible solutions to the given problems. This book describes recent advances in the theory and practice of one such search method, called Genetic Algorithms. Genetic algorithms are evolutionary search techniques based on principles derived from natural population genetics, and are currently being applied to a variety of difficult problems in science, engineering, and artificial intelligence. This three volume set (CCIS 1237-1239) constitutes the proceedings of the 18th International Conference on Information Processing and Management of Uncertainty in Knowledge-Based Systems, IPMU 2020, in June 2020. The conference was scheduled to take place in Lisbon, Portugal, at University of Lisbon, but due to COVID-19 pandemic it was held virtually. The 173 papers were carefully reviewed and selected from 213 submissions. The papers are organized in topical sections: homage to Enrique Ruspini; invited talks; foundations and mathematics; decision making, preferences and votes; optimization and uncertainty; games; real world applications; knowledge processing and creation; machine learning I; machine learning II; XAI; image processing; temporal data processing; text analysis and processing; fuzzy interval analysis; theoretical and applied aspects of imprecise probabilities; similarities in artificial intelligence; belief function theory and its applications; aggregation: theory and practice; aggregation: pre-aggregation functions and other generalizations of monotonicity; aggregation: aggregation of different data structures; fuzzy methods in data mining and knowledge discovery; computational intelligence for logistics and transportation problems; fuzzy implication functions; soft methods in statistics and data analysis; image understanding and explainable AI; fuzzy and generalized quantifier theory; mathematical methods towards dealing with uncertainty in applied sciences; statistical image processing and analysis, with applications in neuroimaging; interval uncertainty; discrete models and computational intelligence; current techniques to model, process and describe time series; mathematical fuzzy logic and graded reasoning models; formal concept analysis, rough sets, general operators and related topics; computational intelligence methods in information modelling, representation and processing.

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Criteria based on completion times.- 2.3.1.2. Criteria based on due dates.- 2.3.1.3. Criteria based on inventory cost and utilization.- 2.3.2. Relations between criteria.- 2.3.3. Analysis of scheduling costs.- 2.4. Classification of problems.- 3. Methods of Solution.- 3.1. Complete enumeration.- 3.2. Combinatorial analysis.- 3.3. Mixed integer and non-linear programming.- 3.3.1. [Bowman 1959].- 3.3.2. [Pritsker et al. 1969].

Solving Job-shop Scheduling Problems with Fuzzy Durations Using Genetic Algorithms

Solving Job Shop Scheduling Problem Using Genetic Algorithms

20th International Conference on Intelligent Systems Design and Applications (ISDA 2020) held December 12-15, 2020

Integration of AI and OR Techniques in Constraint Programming for Combinatorial Optimization Problems

5th European Conference, EvoCOP 2005, Lausanne, Switzerland, March 30 - April 1, 2005, Proceedings

Genetic Algorithm for Solving Job-shop Scheduling Problem

This book is a printed edition of the Special Issue " Algorithms for Scheduling Problems" that was published in Algorithms

Besides scheduling problems for single and parallel machines and shop scheduling problems, the book covers advanced models involving due-dates, sequence dependent change-over times and batching. A discussion of multiprocessor task scheduling and problems with multi-purpose machines is accompanied by the methods used to solve such problems, such as polynomial algorithms, dynamic programming procedures, branch-and-bound algorithms and local search heuristics, and the whole is rounded off with an analysis of complexity issues.

In this thesis, the Job Shop Scheduling Problem (JSSP) is the problem of interest. The classical JSSP is well-known as an NP-hard problem. Although with current computational capabilities, the small problems are solvable using deterministic methods, it is out of reach when they are larger in size. The complexity of JSSP is further increased when process interruptions, such as machine breakdown and/or machine unavailability, are introduced. Over the last few decades, several stochastic algorithms have been proposed to solve JSSPs. However, none of them are suitable for all kinds of problems. Genetic and Memetic algorithms have proved their effectiveness in these regards, because of their diverse searching behavior. In this thesis, we have developed one genetic algorithm and three different Memetic Algorithms (MAs) for solving JSSPs. Three priority

rules are designed, namely partial re-ordering, gap reduction and restricted swapping, and these have been used as local search techniques in designing our MAs. We have solved 40 well-known benchmark problems and compared the results obtained with some of the established algorithms available in the literature. Our algorithm clearly outperforms those established algorithms. For better justification of the superiority of MAs over GA, we have performed statistical significance testing (Student's t-test). The experimental results show that MA, as compared to GA, not only significantly improves the quality of solutions, but also reduces the overall computation. We have extended our work by proposing an improved local search technique, shifted gap-reduction (SGR), which improves the performance of MAs when tested with the relatively difficult test problems. We have also modified the new algorithm to accommodate JSSPs with machine unavailability and also developed a new reactive scheduling technique to re-optimize the schedule after machine breakdowns. We have considered two scenarios of machine unavailability. Firstly, where the unavailability information is available in advance (predictive), and secondly, where the information is known after a real breakdown (reactive). We show that the revised schedule is mostly able to recover if the interruptions occur during the early stages of the schedules. We also confirm that the effect of a single continuous breakdown has more impact compared to short multiple breakdowns, even if the total durations of the breakdowns are the same. Finally, for convenience of implementation, we have developed a decision support system (DSS). In the DSS, we have built a graphical user interface (GUI) for user friendly data inputs, model choices, and output generation. This DSS tool will help users in solving JSSPs without understanding the complexity of the problem and solution approaches, as well as will contribute in reducing the computational and operational costs.

Computational Intelligence in Flow Shop and Job Shop Scheduling

Evolutionary Computation in Combinatorial Optimization

Computational Science – ICCS 2020

Solving Job Shop Scheduling Problem Using Priority Dispatching Rules Method

Solving Job-shop Scheduling Problem Using Tabu Search Method

Machine Scheduling Problems

This dissertation, "An Evolutionary Algorithm Approach for Assembly Job Shop Scheduling With Lot Streaming Technique" by Tse-chiu, Wong, ???, was obtained from The University of Hong Kong (Pokfulam, Hong Kong) and is being sold pursuant to Creative Commons: Attribution 3.0 Hong Kong License. The content of this

dissertation has not been altered in any way. We have altered the formatting in order to facilitate the ease of printing and reading of the dissertation. All rights not granted by the above license are retained by the author.

Abstract: Abstract of thesis entitled "An Evolutionary Algorithm Approach for Assembly Job Shop Scheduling with Lot Streaming Technique" Submitted by Wong Tse Chiu for the degree of Doctor of Philosophy at The University of Hong Kong in December 2007 Considerable efforts have been made by many manufacturing practitioners and researchers in recent years to solve Production and Scheduling Problems (PSPs). To solve PSPs, decision makers need to optimize the system objectives and satisfy the system constraints within a practical time limit. In this connection, a number of evolutionary approaches have been developed in this field. The Job Shop Scheduling Problem (JSSP) is one of the better-known PSPs, in which jobs are processed on machines in distinct orders. To solve a JSSP, the job processing sequence on each machine should be determined with respect to the objective functions. In fact, the classical JSSP is simplified by a number of system assumptions. One assumption is ii that a job cannot be split. Generally, a job is defined as a batch of identical items and it can only be transferred to the next machine once the whole batch has been processed. If a job is not allowed to be split, its next operation cannot be started even some items of the batch have already been processed. To relax this assumption, decision makers eventually need to decide for each job: (1) Whether the job will be split; (2) the sub-job number; and (3) the size of each sub-job. This technique is called Lot Streaming (LS). LS is defined as the process of splitting jobs into smaller sub-jobs so that successive operations of the same job can be overlapped on different machines. Nevertheless, insufficient LS models have been dedicated to JSSP. Another assumption of the classical JSSP is that there is no assembly stage. In other words, each job in JSSP is independent. If an assembly stage is appended to JSSP, the problem then becomes the Assembly Job Shop Scheduling Problem (AJSSP). In this study, the application of LS is for the first time extended to the AJSSP. As the potential of employing LS to the AJSSP has not been fully studied, an intelligent evolutionary algorithm is proposed and examined. The application of LS to JSSP is investigated first. Accordingly, an evolutionary algorithm is proposed. The research problem is divided into Sub-Problem One (SP1) and Sub-Problem Two (SP2). SP1 is defined as the determination of three LS conditions and SP2 is defined as JSSP after LS conditions have been determined. Different system parameters such as 3-level processing time range, 5-level setup time range, and 4-level system congestion index are examined. The computational results are obtained and discussed. Next, the application of LS is extended to the AJSSP. In iii this connection, the problem is considered in three parts: (a) Part I, on a simplified AJSSP; (b) Part II, on an

AJSSP with 4-level part sharing; and (c) Part III, on an AJSSP with 4-level part sharing, 4-level system congestion index, and 2-level resource constraints. Correspondingly, the evolutionary algorithm is modified and improved in terms of optimization powers and computational effort. The computational results are obtained and discussed. _____ iv DOI:

10.5353/th_b3963446 Subjects: Genetic algorithms

Presents current developments in the field of evolutionary scheduling and demonstrates the applicability of evolutionary computational techniques to solving scheduling problems This book provides insight into the use of evolutionary computations (EC) in real-world scheduling, showing readers how to choose a specific evolutionary computation and how to validate the results using metrics and statistics. It offers a spectrum of real-world optimization problems, including applications of EC in industry and service organizations such as healthcare scheduling, aircraft industry, school timetabling, manufacturing systems, and transportation scheduling in the supply chain. It also features problems with different degrees of complexity, practical requirements, user constraints, and MOEC solution approaches. Evolutionary Computation in Scheduling starts with a chapter on scientometric analysis to analyze scientific literature in evolutionary computation in scheduling. It then examines the role and impacts of ant colony optimization (ACO) in job shop scheduling problems, before presenting the application of the ACO algorithm in healthcare scheduling. Other chapters explore task scheduling in heterogeneous computing systems and truck scheduling using swarm intelligence, application of sub-population scheduling algorithm in multi-population evolutionary dynamic optimization, task scheduling in cloud environments, scheduling of robotic disassembly in remanufacturing using the bees algorithm, and more. This book: Provides a representative sampling of real-world problems currently being tackled by practitioners Examines a variety of single-, multi-, and many-objective problems that have been solved using evolutionary computations, including evolutionary algorithms and swarm intelligence Consists of four main parts: Introduction to Scheduling Problems, Computational Issues in Scheduling Problems, Evolutionary Computation, and Evolutionary Computations for Scheduling Problems Evolutionary Computation in Scheduling is ideal for engineers in industries, research scholars, advanced undergraduates and graduate students, and faculty teaching and conducting research in Operations Research and Industrial Engineering. This book provides a theoretical and application-oriented analysis of deterministic scheduling problems in advanced planning and computer systems. The text examines scheduling problems across a range of parameters: job priority, release times, due dates, processing times, precedence constraints, resource usage

and more, focusing on such topics as computer systems and supply chain management. Discussion includes single and parallel processors, flexible shops and manufacturing systems, and resource-constrained project scheduling. Many applications from industry and service operations management and case studies are described. The handbook will be useful to a broad audience, from researchers to practitioners, graduate and advanced undergraduate students.

Algorithms for Scheduling Problems

Scheduling Algorithms

Intelligent Systems Design and Applications

Evolutionary Algorithms for Solving Job-shop Scheduling Problems in the Presence of Process Interruptions

Solving Job Shop Scheduling Problem Using Tabu Search Method with Different Neighbouring Structure

A Heuristic Solution to the General Job Shop Scheduling Problem

The seven-volume set LNCS 12137, 12138, 12139, 12140, 12141, 12142, and 12143 constitutes the proceedings of the 20th International Conference on Computational Science, ICCS 2020, held in Amsterdam, The Netherlands, in June 2020.* The total of 101 papers and 248 workshop papers presented in this book set were carefully reviewed and selected from 719 submissions (230 submissions to the main track and 489 submissions to the workshops). The papers were organized in topical sections named: Part I: ICCS Main Track Part II: ICCS Main Track Part III: Advances in High-Performance Computational Earth Sciences: Applications and Frameworks; Agent-Based Simulations, Adaptive Algorithms and Solvers; Applications of Computational Methods in Artificial Intelligence and Machine Learning; Biomedical and Bioinformatics Challenges for Computer Science Part IV: Classifier Learning from Difficult Data; Complex Social Systems through the Lens of Computational Science; Computational Health; Computational Methods for Emerging Problems in (Dis-)Information Analysis Part V: Computational Optimization, Modelling and Simulation; Computational Science in IoT and Smart Systems; Computer Graphics, Image Processing and Artificial Intelligence Part VI: Data Driven Computational Sciences; Machine Learning and Data Assimilation for Dynamical Systems; Meshfree Methods in Computational Sciences; Multiscale Modelling and Simulation; Quantum Computing Workshop Part VII: Simulations of Flow and Transport: Modeling, Algorithms and Computation; Smart Systems: Bringing Together Computer Vision, Sensor Networks and Machine Learning; Software Engineering for Computational Science; Solving Problems with Uncertainties; Teaching Computational Science; UNcErtainty QUantIficatiOn for ComputatiOnAl modeLs

*The conference was canceled due to the COVID-19 pandemic.

This volume contains the proceedings of EvoCOP 2005, the 5th European Conference on Evolutionary Computation in

Combinatorial Optimization. It was held in Lausanne, Switzerland, on 30 March–1 April 2005...

The evolution of soft computing applications has offered a multitude of methodologies and techniques that are useful in facilitating new ways to address practical and real scenarios in a variety of fields. In particular, these concepts have created significant developments in the engineering field. Soft Computing Techniques and Applications in Mechanical Engineering is a pivotal reference source for the latest research findings on a comprehensive range of soft computing techniques applied in various fields of mechanical engineering. Featuring extensive coverage on relevant areas such as thermodynamics, fuzzy computing, and computational intelligence, this publication is an ideal resource for students, engineers, research scientists, and academicians involved in soft computing techniques and applications in mechanical engineering areas.

Principles of Sequencing and Scheduling

Soft Computing Techniques and Applications in Mechanical Engineering

A Hybrid Parallel Genetic Algorithm for Solving Job-shop Scheduling Problems

Solving Job Shop Scheduling Problem (JSSP) with Different Performance Measures Using LRNN Method

An Evolutionary Algorithm Approach for Assembly Job Shop Scheduling with Lot Streaming Technique

Handbook on Scheduling

For over fifty years now, the famous problem of flow shop and job shop scheduling has been receiving the attention of researchers in operations research, engineering, and computer science. Over the past several years, there has been a spurt of interest in computational intelligence heuristics and metaheuristics for solving this problem. This book seeks to present a study of the state of the art in this field and also directions for future research.

This book constitutes the thoroughly refereed post-conference proceedings of the 5th International Conference on Learning and Intelligent Optimization, LION 5, held in Rome, Italy, in January 2011. The 32 revised regular and 3 revised short papers were carefully reviewed and selected from a total of 99 submissions. In addition to the contributions to the general track there are 11 full papers and 3 short papers presented at the following four special sessions; IMON: Intelligent Multiobjective Optimization, LION-PP: Performance Prediction Self* EAs: Self-tuning, self-configuring and self-generating evolutionary algorithms LION-SWAP: Software and Applications.

This Festschrift volume is published in honor of Juraj Hromkovi? on the occasion of his 60th birthday. Juraj Hromkovi? is a leading expert in the areas of automata and complexity theory, algorithms for hard problems, and computer science education. The contributions in this volume reflect the breadth and impact of his work. The volume contains 35 full papers related to Juraj Hromkovi?'s research. They deal

with various aspects of the complexity of finite automata, the information content of online problems, stability of approximation algorithms, reoptimization algorithms, computer science education, and many other topics within the fields of algorithmics and complexity theory. Moreover, the volume contains a prologue and an epilogue of laudations from several collaborators, colleagues, and friends.

**Solving the Job Shop Scheduling Problem Using the Method of Priority Dispatching Rules
Classification, complexity and computations**

**A New Approach for Solving the Job Shop Scheduling Problem with Tooling Constraints
Learning and Intelligent Optimization**

**Essays Dedicated to Juraj Hromkovi? on the Occasion of His 60th Birthday
From Theory to Applications**

This book offers fourteen select papers presented at the recent Asia-Pacific Symposia on Intelligent and Evolutionary Systems. They illustrate the breadth of research in the field with applications ranging from business to medicine to network optimization.

This book constitutes the refereed proceedings of the First International Conference on Integration of AI and OR Techniques in Constraint Programming for Combinatorial Optimization Problems, CPAIOR 2004, held in Nice, France in April 2004. The 23 revised full papers and 7 revised short papers presented together with an invited talk were carefully reviewed and selected from 56 submissions. Methodological and foundational issues from AI, OR, and algorithmics are presented as well as applications to the solution of combinatorial optimization problems in various fields via constraint programming.

Jens Kuhpfahl analyzes the job shop scheduling problem with minimizing the total weighted tardiness as objective. First, he provides a suitable graph representation based on a disjunctive graph formulation. Second, several key components of local search procedures are analyzed and enhanced. The resulting outputs of these investigations contribute to the development of a new solution procedure whose performance quality leads to superior computational results.

Research on Immune Genetic Algorithm for Solving the Job-shop Scheduling Problem

Solving Job Shop Scheduling Problem by Using Tabu Search Method

Information Processing and Management of Uncertainty in Knowledge-Based Systems

Potentials of Local Search Based Solution Techniques

Solving the General Multiprocessor Job-shop Scheduling Problem

Evolutionary Computation in Scheduling

An updated edition of the text that explores the core topics in scheduling theory The second edition of Principles of Sequencing and Scheduling has been revised and updated to provide comprehensive coverage of sequencing and scheduling topics as well as emerging developments in the field. The text offers balanced coverage of deterministic models and stochastic models and includes new developments in safe scheduling and project scheduling, including coverage of project analytics. These new topics help bridge the gap between classical scheduling and actual practice. The authors—noted experts in the field—present a coherent and detailed introduction to the basic models,

problems, and methods of scheduling theory. This book offers an introduction and overview of sequencing and scheduling and covers such topics as single-machine and multi-machine models, deterministic and stochastic problem formulations, optimization and heuristic solution approaches, and generic and specialized software methods. This new edition adds coverage on topics of recent interest in shop scheduling and project scheduling. This important resource: Offers comprehensive coverage of deterministic models as well as recent approaches and developments for stochastic models Emphasizes the application of generic optimization software to basic sequencing problems and the use of spreadsheet-based optimization methods Includes updated coverage on safe scheduling, lognormal modeling, and job selection Provides basic coverage of robust scheduling as contrasted with safe scheduling Adds a new chapter on project analytics, which supports the PERT21 framework for project scheduling in a stochastic environment. Extends the coverage of PERT 21 to include hierarchical scheduling Provides end-of-chapter references and access to advanced Research Notes, to aid readers in the further exploration of advanced topics Written for upper-undergraduate and graduate level courses covering such topics as scheduling theory and applications, project scheduling, and operations scheduling, the second edition of Principles of Sequencing and Scheduling is a resource that covers scheduling techniques and contains the most current research and emerging topics.

This book highlights recent research on intelligent systems and nature-inspired computing. It presents 130 selected papers from the 19th International Conference on Intelligent Systems Design and Applications (ISDA 2020), which was held online. The ISDA is a premier conference in the field of computational intelligence, and the latest installment brought together researchers, engineers and practitioners whose work involves intelligent systems and their applications in industry. Including contributions by authors from 40 countries, the book offers a valuable reference guide for all researchers, students and practitioners in the fields of Computer Science and Engineering. The last few years have seen important advances in the use of genetic algorithms to address challenging optimization problems in industrial engineering. Genetic Algorithms and Engineering Design is the only book to cover the most recent technologies and their application to manufacturing, presenting a comprehensive and fully up-to-date treatment of genetic algorithms in industrial engineering and operations research. Beginning with a tutorial on genetic algorithm fundamentals and their use in solving constrained and combinatorial optimization problems, the book applies these techniques to problems in specific areas--sequencing, scheduling and production plans, transportation and vehicle routing, facility layout, location-allocation, and more. Each topic features a clearly written problem description, mathematical model, and summary of conventional heuristic algorithms. All algorithms are explained in intuitive, rather than highly-technical, language and are reinforced with illustrative figures and numerical examples. Written by two internationally acknowledged experts in the field, Genetic Algorithms and Engineering Design features original material on the foundation and application of genetic algorithms, and also standardizes the terms and symbols used in other sources--making this complex subject truly accessible to the beginner as well as to the more advanced reader. Ideal for both self-study and classroom use, this self-contained reference provides indispensable state-of-the-art guidance to professionals and students working in industrial engineering, management science, operations

*research, computer science, and artificial intelligence. The only comprehensive, state-of-the-art treatment available on the use of genetic algorithms in industrial engineering and operations research . . . Written by internationally recognized experts in the field of genetic algorithms and artificial intelligence, Genetic Algorithms and Engineering Design provides total coverage of current technologies and their application to manufacturing systems. Incorporating original material on the foundation and application of genetic algorithms, this unique resource also standardizes the terms and symbols used in other sources--making this complex subject truly accessible to students as well as experienced professionals. Designed for clarity and ease of use, this self-contained reference: * Provides a comprehensive survey of selection strategies, penalty techniques, and genetic operators used for constrained and combinatorial optimization problems * Shows how to use genetic algorithms to make production schedules, solve facility/location problems, make transportation/vehicle routing plans, enhance system reliability, and much more * Contains detailed numerical examples, plus more than 160 auxiliary figures to make solution procedures transparent and understandable*

Adventures Between Lower Bounds and Higher Altitudes

5th International Conference, LION 5, Rome, Italy, January 17-21, 2011, Selected Papers

Proceedings of the First International Conference on Genetic Algorithms and their Applications

Genetic Algorithms and Engineering Design

Simulated Annealing Approach for Solving Job Shop Scheduling Problem with Makespan and Total Weighted Tardiness

A Note on the Paper