Summaries

Wojciech Bożejko, Józef Grabowski, Mieczyslaw Wodecki: **Block Approach-Local Search Algorithm for Single Machine Total Weighted Tardiness Problem** • Automatyka 2005, t. 9, z. 1–2

This paper deals with the single-machine scheduling problem to minimize total weighted tardiness of jobs. Some new properties of the problem have been presented and discussed. These properties allow us to propose a new fast tabu search approach with a specific neighborhood which employs blocks of jobs and a compound moves technique. The proposed algorithm is empirically evaluated and found to be relatively more effective in finding good solutions in a shorter time than existing algorithms.

Keywords: *sequencing, weighted tardiness problem, heuristics, tabu search*

Zbigniew Buchalski: **An Heuristic Algorithm for the Tasks Scheduling on Parallel Machines System with Simultaneous Resources Allocation** • Automatyka 2005, t. 9, z. 1–2

In the paper problem of time-optimal allocation of n independent tasks and nonrenewable resources to m parallel machines is considered. For some tasks execution time function the mathematical model of this problem is formulated and an heuristic algorithm for solution this problem is presented. Some results of executed numerical experiment for basis of proposed heuristic algorithm are presented.

Keywords: *discrete productive system, tasks scheduling, heuristic algorithms*

Wojciech Chmiel, Piotr Kadłuczka: **Conditional Expected Value of Objective Function in Approximate Algorithms for Pemutational Problems** • Automatyka 2005, t. 9, z. 1–2

This paper investigates an application of advanced evolutionary algorithms in optimization of permutation problems. The introduction of additional parameter in algorithms – the expected value of objective function – allows effective evaluation of quality of partially fixed solutions. The parameter can be used as auxiliary criterion for selection and construction of new solutions, increasing the effectiveness of designed algorithms.

Keywords: *quadratic assignment problem, QAP, approximate algorithms, evolutionary algorithms, conditional expected value of objective function*

Grzegorz Dobrowolski, Edward Nawarecki: **Critical Situations in Multi-Agent Systems** • Automatyka 2005, t. 9, z. 1–2

Based on the original definitions of: agent, system, activity, resource, a model of critical situations in multi-agent systems is proposed. The proposed approach allows, among others, to define functions of a monitoring sub-system, which observes a system under consideration. Next, a simulation model can be created, which is oriented to searching for anti-crisis strategies or, at least, activities, which can delimit effects of a crisis.

Keywords: *multi-agent system, critical situation, simulation*

Lidia Dutkiewicz, Edyta Kucharska: **Model for Scheduling Problem with State Dependent Resources** • Automatyka 2005, t. 9, z. 1–2

The aim of the paper is to present algebraic-logical model for specific task scheduling problem. In this problem machines need transport. Characteristic thing is that resources, which are required to accomplishing the tasks, are changeable and depend on the current state of the system. Proposed model includes the possibility that machine waits for resources to be accessible. This problem belongs to NP-hard class. The algebraic-logical model is used for simulation and optimization of this decision.

Keywords: *algebraic-logical model, task scheduling, resources*

Bogusław Filipowicz, Joanna Kwiecień: **The Application of Artificial Immune System for Flow Shop Problem** • Automatyka 2005, t. 9, z. 1–2

Artificial immune systems (AIS) have been more and more popular with artificial intelligence methods in the past several years. This article presents an application of artificial immune system for combinatorial optimization problems such as flow shop sheduling problem. Thanks to antibodies evolution based on clonal selection and affinity maturation of artificial immune systems, we can find the solution that minimizes the makespan. Some experiments with different number of jobs and machines show that AIS are an effective method for solving flow shop problem.

Keywords: *artificial immune systems, flow shop scheduling*

Krzysztof Giaro, Marek Kubale: **Scheduling in Sparse Systems of 1- and 2-processor UET Tasks within Time Windows** • Automatyka 2005, t. 9, z. 1–2

In the paper sparse systems of dedicated 1- and 2-processor tasks with unit execution times are considered. Polynomial-time algorithms based on dynamic programming are given. These algorithms allow finding optimal solutions with respect to broad range of criterion functions. The sparsity of a system is measured in terms of the number of edges in the corresponding scheduling graph. More precisely, we are focused on graphs whose cyclomatic number is bounded by a constant. Our algorithms invoke procedures for finding maximal matching in graphs.

Keywords: *polynomial algorithm, graph coloring, time windows, task scheduling, multiprocessor tasks, NP-completeness*

Józef Grabowski, Jarosław Pempera: **Flow Shop with No Store Constraints. Algorithm TS with Multimoves** • Automatyka 2005, t. 9, z. 1–2

The paper deal with flow-shop scheduling problem with no store constrains and the makespan criterion. Some properties, models of the problem and algorithm based on the taboo search method have been presented and discussed. In the proposed algorithm, the blocks of jobs ideas and new mechanism called multimove are used. The high efficiency of proposed mechanism confirm the results of the computation experiment, where for 96 over 120 instances are obtained new references solution.

Keywords: *flow shop problem, no store constraints, tabu search algorithm*

Piotr Kadłuczka, Wojciech Chmiel: **Efficiency of Evolution Algorithm with Conditional Expected Value of Objective Function** • Automatyka 2005, t. 9, z. 1–2

The papers presents the results of our work on implementation and testing of new evolutionary algorithms for optimization of permutation problems. The algorithm flow is controlled by an additional parameter that is used for evaluation of quality of partially fixed solutions: the expected value of objective function. As an example, the quadratic assignment problem *QAP* is examined.

Keywords: *quadratic assignment problem, QAP, approximate algorithms, evolutionary algorithms, genetic operators, conditional expected value of objective function*

Andrzej Kononowicz, Małgorzata Żabińska: **Distribution of Learning Objects Based on Agents' Technology** • Automatyka 2005, t. 9, z. 1–2

Possibility of multiple use of the learning material adjusted to the new media, enables quick development of E-Learning systems. For this purpose the contents of a teaching/learning subject is divided into smaller, consistent parts, named "learning objects". They can be, similarly as objects in programming, appropriately chosen and merged into bigger units. Such composition of the learning/teaching material creates new possibilities of individual adjustment of education process to learners' needs. Agent's technology in E-Learning may be applied as an intermediate layer between learners as well as stores of learning objects, available in the Internet or local academic networks. Software agents, owing to own observations of their principals' behaviour, and also storing preferences of the latter ones, can make the process of learning/teaching materials search much more efficient. A concept of agents' platform for publishing and search of learning/teaching materials, analysis of tasks of software agents acting within the platform, and a prototype performing selected functions of such a platform have been presented in the paper.

Keywords: *software agents, E-Learning, learning objects, multiagent systems*

Mariusz Makuchowski: **Genetic Algorithm for No-Wait Job Shop Problem** • Automatyka 2005, t. 9, z. 1–2

The paper deals with the no-wait job shop scheduling problem with the makespan criterion. The new class of so called "super-active" solution is introduced. Two genetic algorithms SGA and PGA, based on aforementioned class, and the class of "pseudo-active" schedules, are proposed. These algorithms are tested on "easy" and "hard" benchmarks well-know in literature. Results of computational experiments are given and they are compared with results yielded by the best genetic algorithm discusses in literature.

Keywords: *no-wait job shop problem, super active solutions, pseudo active solutions, genetic algorithm*

Wojciech Mitkowski, Krzysztof Oprzędkiewicz: **The Control Problems for a Class of Linear Uncertain Parameter Dynamic Systems** • Automatyka 2005, t. 9, z. 1–2

In paper problems of control for a class of finite-dimensional uncertain parameter linear dynamic systems were presented. The

system under consideration is described by a linear state-space equation with an uncertam-parameter state matrix and real control and output matrices. The elements of the state matrix are linear functions of uncertain parameters. The problem of transformation the state-space equation to the Jordan's canonical form were considered. The controllability and observability conditions based onto the geometrical interpretation of the syatem's spectrum were also formulated. The results were illustrated with numerical examples.

Keywords: *uncertain-parameter systems, controllability, observability*

Marcin Molga, Czesław Smutnicki: **Modelling, Analysis and Optimization of Orderpicking Systems** • Automatyka 2005, t. 9, z. 1–2

This paper deals with conveyor flow-shop problem with one mobile processor and some time criterion. Graph model have been presented. The authors proposed some fast algorithms solving problem mentioned above. The efficiency of discussed algorithms has been proved on random population of test instances.

Keywords: *orderpicking systems, optimization*

Iwona Oprzędkiewicz: **A Meeting of Real-Time Requirements Inside a PLC's Family** • Automatyka 2005, t. 9, z. 1–2

In the paper problems of real-time requirements for the PLC-based control systems were discussed. Experiments were done for the PLC-s belonging to the same "family". The presented problems are important from the point of view the practice, because theoretical and experimental results make possible the correct configuration the PLC-based control system.

Keywords: *PLC, Real-Time Control Systems*

Krzysztof Oprzędkiewicz: **A PID Controller for a Class of Uncertain-Parameter Linear Dynamic Systems** • Automatyka 2005, t. 9, z. 1–2

In the paper the problems of PID control for a class of uncertain-parameter linear dynamic systems are preseneted. The focused system is described by the transfer function. The coefficients of the

transfer function are linear functions of uncertain parameters. For this system the robust stability problem and the tunning the PID controller with the Ziegler–Nochols rules are dicussed. The results are by a numerical example depicted.

Keywords: *PID cotrol, uncertain-parameter systems*

Jarosław Pempera, Czesław Smutnicki: **Minimizing Cycle Time on a Flow Line. Genetic Approach with Gene Expression** • Automatyka 2005, t. 9, z. 1–2

This paper deals with the flow shop scheduling problem with no store policy to minimize cycle time criterion. Some properties and models of the problem are presented. We propose new genetic algorithms, with auxiliary gene expression method, which creates offspring using genetic information from both parents as well as from ancestors (grandfather, grandgrandfather). The proposed algorithm has been tested on the Taillard's benchmarks. The presented computational results provide superiority of proposed approach over classical GA.

Keywords: *flow shop scheduling, cycle time, genetic algorithm*

Adam Piórkowski: **Heuristic Algorithms of Message Scheduling for Messages with Deadlines** • Automatyka 2005, t. 9, z. 1–2

The article presents the problem of optimizing the asynchronous communication in message queuing systems. A system model is created and as well as the question of optimal communication discussed. A special importance is attached to the problem of dividing the stream of transmitted data into web packets. The time of awaiting for the message taking the occurrence mentioned above into consideration is stated. Lack of precise algorithm for optimizing the total cost $\sum w_j C_j$ for discussed problem by it's transformation into the knapsack problem is proved. Heuristic algorithms based on bubble sorting, moving the small message into the front of the queue and changing with assessment of the potential gain or distance are proposed. An application simulating the random data sets and optimizing using methods previously described, is created. RT STD and permutations results are presented to compare. Achieved results are discussed.

Keywords: *message scheduling, real-time systems, distributed systems*

Tadeusz Sawik: **A Multi-Objective Assignment of Customer Orders to Planning Periods in Make-to-Order Manufacturing** • Automatyka 2005, t. 9, z. 1–2

This paper presents mixed integer programming formulations and compares two approaches – weighting and lexicographic – to a multi-objective, long-term production scheduling in make-to-order manufacturing. The problem objective is to assign customer orders for various product types and with various due dates to planning periods and to select machines for assignment in every period to complete all the orders with minimum numbers of tardy and early orders and levelled machine assignments over a planning horizon. The two approaches are applied to optimize long-term production schedules in a flexible flowshop with parallel machines. Numerical examples modeled after a real-world flexible assembly line in the electronics industry are provided and some computational results are reported.

Keywords: *production scheduling, multi-objective integer programming, supply chain optimization*

Czesław Smutnicki, Adam Tyński: **Job Scheduling in the Flexible Manufacturing System with AGV Vehicles** • Automatyka 2005, t. 9, z. 1–2

In this paper the flow shop manufacturing system is considered in which machines are organized into single loop layout and all jobs have to be transported between the machines by a single unidirectional AGV. As a goal function we take the time of completion of all jobs. For the problem the mathematical model and the permutation-graph representation is introduced which are supported by a comprehensive computational example.

Keywords: *scheduling, flow shop, transport AGV*

Czesław Smutnicki, Adam Tyński: **The Job-Shop Problem with Transportation and Limited Number of Undedicated AGV Vehicles** • Automatyka 2005, t. 9, z. 1–2

In this paper the job-shop scheduling problem with transportation is considered. All jobs have to be transported by the finite number of bi-directional automated guided vehicles which are identical and are not assigned to jobs *a priori*. As goal function we take the

completion time of all jobs. For the problem, we propose the algorithm based on tabu search technique. To examine the quality of provided results, computational tests on test instances are performed.

Keywords: *job-shop, AGV, tabu search*

Marcin Tusiewicz: **Distributed Complete Search with Branch--and-Bound for *NP*-Hard Problems** • Automatyka 2005, t. 9, z. 1–2

Optimum finding of *NP*-hard problems in wide distributed environments algorithm is presented. As an main example 0–1 Knapsack Problem is solved using distributed complete search with branch-and-bound technique. Distributed environment model proposed by the author is used to describe the algorithm and efficiency estimations.

Keywords: *complete search, NP-hard problems, distributed branch-and-bound*