Handbook of Research on

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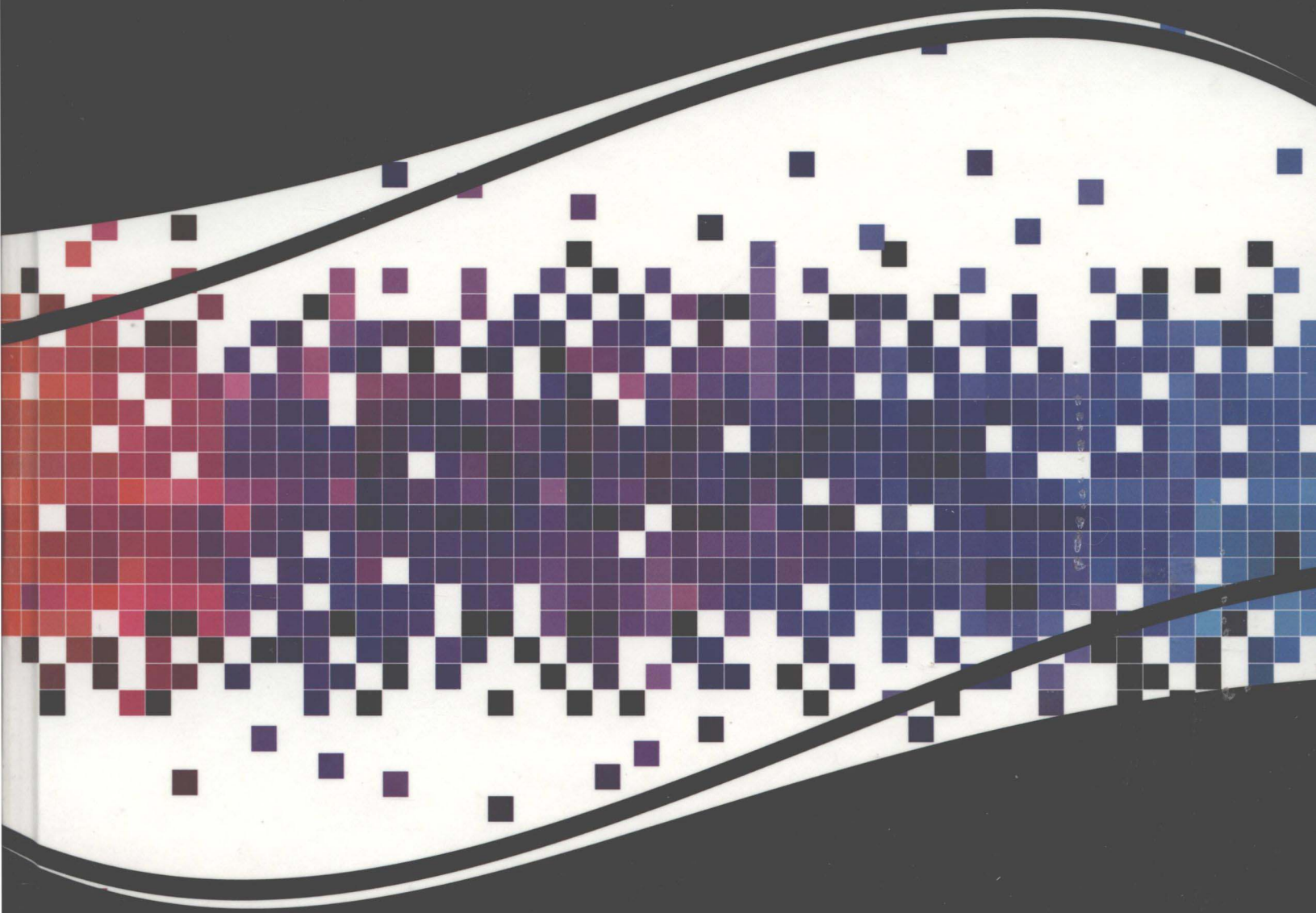

Pandian Vasant, Gerhard-Wilhelm Weber, and Vo Ngoc Dieu

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Handbook of Research on Modern Optimization Algorithms and Applications in Engineering and Economics

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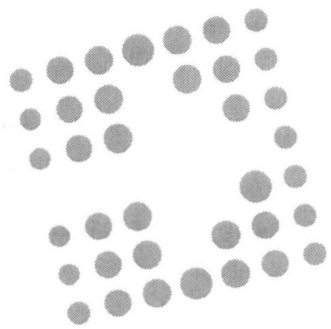

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with applications and computational complexity issues. A class of multistage robust optimization problems for which exact optimal strategies can be efficiently computed (via a robust dynamic programming recursion) is discussed. An application to a multiperiod energy production planning problem is presented into detail, and computational results are reported.

Supply chain network design is one of the most important strategic issues in operations management. The main objective in designing a supply chain is to keep the cost as low as possible. However, the modelling of a supply chain requires more than single-objective such as lead-time minimization, service level maximization, and environmental impact maximization among others. Usually these objectives may cause conflicts such as increasing the service level usually causes a growth in costs. Therefore, the aim should be to find trade-off solutions to satisfy the conflicting objectives. The aim of this chapter is to propose a new method based on a hybrid version of the Bees Algorithm with Slope Angle Computation and Hill Climbing Algorithm to solve a multi-objective supply chain network design problem. A real case from the literature has been selected and solved in order to show the potentiality of the proposed method in solving a large scale combinatorial problem.

Over the years the supply chain industry has been transforming to improve the end-to-end (production to delivery) process. Supply chain management (SCM) allows various industries to oversee and better handle how their product is manufactured and delivered. It allows them to track and identify the location of the product and to be more efficient in delivery. Integrating total asset visibility (TAV) technology into the supply chain structure can provide excellent visibility of a product. This kind of visibility complemented with various packaging schemes can assist in accommodating optimization strategies for visualizing the movement of a product throughout the entire supply chain pipeline. The chapter will define SCM, discuss TAV, review how transportation as well as optimization impacts SCM and TAV, and examine the role of packaging in the context of SCM and TAV.

In this article it is studied the application of a genetic algorithm in the problem of variable selection for multiple linear regression, minimizing the least squares criterion. The algorithm is based on a chromosomic representation of variables that are considered in the least squares model. A binary chromosome indicates

the presence (1) or absence (0) of a variable in the model. The fitness function is based on the adjusted square R, proportional to the fitness for chromosome selection in a roulette wheel model selection. Usual genetic operators, such as crossover and mutation are implemented. Comparisons are performed with benchmark data sets, obtaining satisfying and promising results.

In power systems, we still lack the existence of standardized test systems that can be used to benchmark the performance and solution quality of proposed optimization techniques. It is therefore necessary to develop new methods for design of test cases for economic analysis in power systems. We compared two methods to generate test systems: time series and a method for simulating stable random variables that can be used to multiperiod unit commitment based on the use of Chambers-Mallows-Stuck. Hence, after comparing both methods, we describe the method for simulating stable random variables in the generation of test systems for economic analysis in power systems. A study focused on generating test electrical systems through fat tail model for unit commitment problem in electrical power systems is presented. Usually, the instances of test systems in Unit Commitment are generated using normal distribution, but in this work, simulations data are based on alpha-stable distribution. Numerical results illustrate the applicability of the proposed method.

In real-world most of manufacturing systems are large, complex, and subject to uncertainty. This is mainly due to events as random demands, breakdowns, repairs of production machines, setup and cycle times, inventory fluctuations and more. If items move too quickly, workers may work too hard. If items move too slowly, workers may have great leisure times. However, must make decisions here and now regarding the operation of the system optimally and quickly. In practice, these decisions are based on recent statistics of the system behavior, in the experience of the analyst and the urgency of the solution. In this chapter, we present a real problem associated with the production of individual parts in metalworking industry for the refrigerators production. We develop a model based on the Markov Decision Process to study the dynamics of the trajectory of end products in a manufacturing line that works by process. Then, we propose a measure of the average production rate of the line by using the Monte Carlo method. We illustrate our proposal using a numerical example with real data obtained in situ.

The second approach, for sequences with consistency, deals with a hybrid GA based on the Divide and Conquer principle (DCP) and it can save space. A consistent dot matrices (CDM) algorithm discovers consistency and creates MSA. The proposed GA (GA_TS_VS) also uses TS but it works with partitions. In conclusion, GAs are stochastic approaches that are proved very beneficial for MSA in terms of their performance.

Chapter 14

This chapter proposes a Cuckoo Search Algorithm (CSA) and a Modified Cuckoo Search Algorithm (MCSA) for solving short-term hydrothermal scheduling (ST-HTS) problem. The CSA method is a new meta-heuristic algorithm inspired from the obligate brood parasitism of some cuckoo species by laying their eggs in the nests of other host birds of other species for solving optimization problems. In the MCSA method, the eggs are first classified into two groups in which ones with low fitness function are put in top group whereas others with higher fitness function are put in abandoned group. In addition, an updated step size in the MCSA changes and tends to decrease as the iteration increases leading to near global optimal solution. The robustness and effectiveness of the CSA and MCSA are tested on several systems with different objective functions of thermal units. The results obtained by the CSA and MCSA are analyzed and compared have shown that the two methods are favorable for solving short-term hydrothermal scheduling problems.

Chapter 15

In this chapter, a general strategy is recommended to solve variety of linear and nonlinear ordinary differential equations (ODEs) with boundary value conditions. With the aid of certain fundamental concepts of mathematics, Fourier series expansion, and metaheuristic algorithms, ODEs can be represented as an optimization problem. The purpose is to reduce the weighted residual error (error function) of the ODEs. Boundary values of ODEs are considered as constraints for the optimization model. Inverted generational distance metric is utilized for evaluation and assessment of approximate solutions versus exact solutions. Four ODEs having different orders and features are approximately solved and compared with their exact solutions. The optimization task is carried out using different optimizers including the particle swarm optimization and the water cycle algorithm. The optimization results obtained show that the proposed method equipped with metaheuristic algorithms can be successfully applied for approximate solving of different types of ODEs.

transportation industry. One of the key Performance pointers of hybrid electric vehicle is the State-of-Charge (SoC) which needs to be enhanced for the advancement of charging station using computational intelligence methods. In this Chapter, authors applied Hybrid Particle swarm and gravitational search Optimization (PSOGSA) technique for intelligently allocating energy to the PHEVs considering constraints such as energy price, remaining battery capacity, and remaining charging time. Computational experiment results attained for maximizing the highly non-linear fitness function estimates the performance measure of both the techniques in terms of best fitness value and computation time.

Chapter 19

A project where activity times are characterized by intervals or triangular fuzzy numbers is considered in this chapter. Classical project evaluation and review technique (PERT) cannot be directly applied to such projects. Comparison of two intervals or two triangular fuzzy numbers plays an important role in this problem. Ranking methods based on some fuzzy mathematical techniques are discussed and two algorithms for finding the critical path for such a project are given. An illustrative example is also provided.

Chapter 20

Multi objective (MO) optimization is an emerging field which is increasingly being implemented in many industries globally. In this work, the MO optimization of the extraction process of bioactive compounds from the Gardenia Jasminoides Ellis fruit was solved. Three swarm-based algorithms have been applied in conjunction with normal-boundary intersection (NBI) method to solve this MO problem. The gravitational search algorithm (GSA) and the particle swarm optimization (PSO) technique were implemented in this work. In addition, a novel Hopfield-enhanced particle swarm optimization was developed and applied to the extraction problem. By measuring the levels of dominance, the optimality of the approximate Pareto frontiers produced by all the algorithms were gauged and compared. Besides, by measuring the levels of convergence of the frontier, some understanding regarding the structure of the objective space in terms of its relation to the level of frontier dominance is uncovered. Detail comparative studies were conducted on all the algorithms employed and developed in this work.

Chapter 21

In the present chapter, we give an overview of iterative methods for linear complementarity problems (abbreviated as LCPs). We also introduce these iterative methods for the problems based on fixed-point

principle. Next, we present some new properties of preconditioned iterative methods for solving the LCPs. Convergence results of the sequence generated by these methods and also the comparison analysis between classic Gauss-Seidel method and preconditioned Gauss-Seidel (PGS) method for LCPs are established under certain conditions. Finally, the efficiency of these methods is demonstrated by numerical experiments. These results show that the mentioned models are effective in actual implementation and competitive with each other.

In this chapter, we propose to perform a numerical technique based on genetic algorithms (GAs) to identify the electrical parameters (Is, Iph, Rs, Rsh, and n) of photovoltaic (PV) solar cells and modules. The one diode type approach is used to model the I–V characteristic of the solar cell. To extract electrical parameters, the approach is formulated as optimization problem. The GAs approach was used as a numerical technique in order to overcome problems involved in the local minima in the case optimization criteria. Compared to other methods, we find that the GAs is a very efficient technique to estimate the electrical parameters of photovoltaic solar cells and modules. Compared with other parameter extraction techniques, based on statistical study, results indicate the consistency and uniformity of method in terms of the quality of final solutions. In parallel, the simulated data with the extracted parameters of method base with GAs are in very good agreement with the experimental data in all cases.

In this chapter, two approaches are developed to solve the integrated production planning and maintenance problem. Moreover, Some Propositions and mathematical properties were suggested and applied in the proposed heuristics to solve the problem. The first heuristic developed is based on Dantzig-Wolfe decomposition. The Dantzig-Wolfe Decomposition principle reformulates the original model and Column generation is then used to deal with the huge number of variables of the reformulated model. A simple rounding heuristic and a smoothing procedure are finally carried out in order to obtain integer solutions. The second heuristic is based on Lagrangean relaxation of the capacity constraints and sub-gradient optimization. At every step of sub-gradient method, feasibility and improvement procedures are applied to the solution of the Lagrangean problem. Computational experiments are carried out to show the results

obtained by our approaches and compared to those of commercial solver.

Chapter 24

The aim of this chapter is to investigate the multiple attribute decision making problems to a selected project with generalized intuitionistic fuzzy information in which the information about weights is completely known and the attributes values are taken from the generalized intuitionistic fuzzy environment. Here, we extend the technique for order performance by similarity to ideal solution (TOPSIS) for the generalized intuitionistic fuzzy data. In addition, obtained the concept of possibility degree of generalized intuitionistic fuzzy numbers and used to solve ranking alternative in multi-attribute decision making problems.

Chapter 25

The optimization of the maintenance decision making can be defined as an attempt to resolve the conflicts of decision situation in such a way that variable under the control of the decision maker take their best possible value. One of the most important controllable parameters is the time interval between maintenance. Most of the researchers have kept the fact that whenever the suitable maintenance interval is reached, the system is replaced with the original one. However the improvement of a system life not only depends on the replacement of deteriorated components, but also on the effectiveness of the maintenance. Taking care about this fact, the effects of maintenance of a multi-component system by combining the three main different PM actions, namely (1a), (1b) and (2p)-maintenance actions. Thus, the main purpose of an effective maintenance program is to present a technique for finding the optimal maintenance interval for the system by considering the multiple goals of the organization viz. maximum availability, minimum maintenance cost.

Chapter 26

A new optimization algorithm, specifically, the cuckoo search algorithm (CSA), which inspired by the unique breeding strategy of cuckoos, has been developed recently. Preliminary studies demonstrated the comparative performances of the CSA as opposed to genetic algorithm and particle swarm optimization, however, with the competitive advantage of employing fewer control parameters. Given enough computation, the CSA is guaranteed to converge to the optimal solutions, albeit the search process associated to the random-walk behavior might be time-consuming. Moreover, the drawback from the fixed step size searching strategy in the inner computation of CSA still remain unsolved. The adaptive cuckoo search algorithm (ACSA), with the effort in the aspect of integrating an adaptive search strategy, was attached in this study. Its beneficial potential are analyzed in the benchmark test function optimization, as well as