this paper two mathematical models have been proposed in order to solve the cell formation and human resource assignment problems. The first mode is to minimize the inter/intra cell part trips, system reconfiguration cost, installing/uninstalling costs of tools on/from different machines and machine breakdown cost, respectively. The second model tries to minimize the operator related issues such as hiring, firing, salary and the training costs. One of the main contributions of this paper is to consider the operator skill level. Actually, the training and forgetting effect of an operator determines his/her work skill level. So, in this paper, this issue is regarded in more details. These two nonlinear models have been linearized and solved using the Gams optimization package. Some numerical examples are generated randomly in order to the performance of proposed models. Moreover, in order to analyze find the optimal solution, the third model, which integrates two mentioned models, has been proposed. Based on the sensitivity analysis of the proposed models, the optimal assignment of operators can significantly improve the solution quality. Also, using the numerical examples' results, the linear model can obtain the optimal solutions in less computational effort in comparison to the nonlinear models.

Key Words: Cellular manufacturing system, operator assignment, operator learning-forgetting effect, multi-functional machines, machine breakdown.

at moderately few number of experiments.

Key Words: Railway, timetabling, simulation optimization, robust optimization, kriging metamodel.

COMBINING QUEUEING THEORY AND FUZZY LOGIC FOR DETERMINING THE OPTIMAL HOTEL CAPACITY IN BOUNDED TWO-DIMENSIONAL KNAPSACK MODEL

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Abstract

Decision making regarding the hotel optimal capacity is one of the most important strategic decisions for the hotel industry executives and investors. This importance arises from the fact that after determining hotel capacity and execution of construction operations, it is not possible to change the capacity of hotel, or the changes will involve much higher costs.

Considerable capacity of hotels and residential centers that are located in a tourist town is empty of passengers and unused in relatively many periods of the year. However, in some limited time periods, number of travelers and tourists is increased due to holidays or various occasions and hotels are encountered with lack of capacity for the accommodation of travelers. In this article, to determine the optimal capacity of the hotel, using a novel approach, an attempt is made to present a mathematical optimization model based upon the queueing theory. To achieve this goal, first the reception system is simulated using the queueing models. Then, the capacity and optimal room numbers of various types using bounded multi-dimensional knapsack model are determined. The objective function of the proposed knapsack model is cost minimization. This cost function is developed by taking into account the time value of money and the sum of two different costs associated with the hotel construction. Due to the uncertainty of some parameters of the problem, the objective function of the model is presented as an objective function with fuzzy coefficients. To solve this model, a single-objective function is converted into three objective functions using the techniques of Lai and Hwang. Then using fuzzy technique of Torabi and Hassini these three objective function problem was converted into a single objective deterministic model. This single objective programming problem was coded in MATLAB to determine the optimal capacity of hotel. The results confirm that the proposed model, unlike other approaches, can be easily and efficiently matched with different situations.

Key Words: Optimal hotel capacity, knapsack problem, queueing theory, fuzzy programming, lai and hwang, Torabi and Hassini.

DESIGNING A CELLULAR MANUFACTURING SYSTEM CONSIDERING THE OPERATOR ASSIGNMENT TO THE UNRELIABLE MULTI-FUNCTIONAL MACHINES IN A DYNAMIC ENVIRONMENT

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Abstract

Manufacturing flexibility is a basic requirement in order to increase both the revenue and customer satisfaction level. Group technology concept can be implemented in such cases. One of the most important applications of group technology concept in a production environment is Cellular Manufacturing System which includes four main sub problems; Cell formation, Group layout, Scheduling and Resource assignment. The cell formation (CF) is for assigning the machines into cells. The Group layout (GL) tries to find the optimal layout of machines within the cells and cells within the production floors. The group scheduling (GS) problem tries to minimize the total production time and ultimately resource assignment (RA) is to assign the manufacturing resources, such as operators into cells, optimally. Accordingly, in

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Abstract

In industrial environments, scheduling systems often operate under dynamic and random circumstances. In these conditions, it is inevitable to encounter some disruptions and breakdowns which are inherently unexpected events. These disruptions bring about the initial schedule to quickly become infeasible and non-optimal and in need of appropriate revisions and rescheduling methods. We consider a flexible flow shop (FFS) system with stochastic or unexpected disruptions such as the arrival of new unpredicted jobs into the process. The occurrence of disruptions and unexpected events in scheduling problems makes the obtaining of robust and stable solutions more valuable than the finding of optimal solutions that ignore these disruptions. In the literature, for achieving stable solutions, either iteration-based time-consuming simulation methods or surrogate measures (SMs) have been developed; they proactively provide an approximation of the system's real conditions following the occurrence of a disruption due to of the discrepancies of these measures with their true values; however, they may not show the true performance of the system. In this paper, a new reactive approach is considered to achieve a stable scheduling despite unpredicted disruptions, such as unexpected arrivals of new jobs. In this approach, a multi-objective reactive method based on classical and new performance measures is used to control the effects of disruptions that reschedule the initial plans after any unexpected event. An innovative concept called the "Stability" is introduced to reduce the effects of the unexpected disruptions. As the FFS problem is NP-hard, considering that stochastic disruptions increase its complexity, the non-dominated Sorting GA-II algorithm or NSGA-II, which is a very famous multi-objective optimization algorithm, is then applied to solve it. To show the performance of the proposed approach, a case study in petrochemical industry is considered. Computational results indicate that this method produces better solutions compared to the classical scheduling approaches used in this company.

Key Words: Online scheduling, disruption, surrogate measures, stability, reactive scheduling.

A ROBUST SIMULATION OPTIMIZATION APPROACH TO URBAN TRAIN SCHEDULING PROBLEM

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Abstract

The train timetabling in a railway network is one of the most critical problems in passenger or freight transportation systems. With uncontrollable noises affecting the system, finding a schedule whose performance does not significantly reduce under various disturbances is vital. A train timetable is considered robust when it has the ability to absorb small disturbances, and its performance does not reduce under the situation of recurring disturbances.

The integer programming problem of robust train timetabling problem with a decision variable and constraint for every train and every block in a railway network takes one an unreasonably long time to solve, and this may be possible after adopting numerous simplifying assumptions. To move around these disadvantages, discrete event simulation is a more appropriate approach. The methodology that combines simulation modeling and optimization techniques for solving optimization problems is commonly referred to as simulation optimization.

In this paper, we introduce a new simulation optimization method to solve the robust optimization of train timetabling problem in metro lines. We aim to minimize the expected value of the passenger's waiting time with a satisfactory rate of carriage fullness. Headways, which are the time intervals between arrivals of two consecutive trains into one station, are considered as the decision variables. It is assumed that the rate of passenger arrival to stations and travel times is stochastic. We first develop the simulation model in a way that the constraints, such as the train waiting times in stations, station capacities, overtaking, and the safe distance between trains, are satisfied. Then, using the inputs/outputs combination of simulation model, two stochastic Kriging metamodels are fitted as one for the objective function and one for the constraint. To write the robust counterpart problem, we use the Bertsimas and Sim methodology for the resulting mathematical model. The final mathematical programming model is solved by PSO metaheuristic. This methodology is applied to a particular line within Tehran railway system. Our approach generates satisfactory solutions to different levels of conservatism factor

considered as the modified processing time for computations. The problem is reformulated as an assignment problem in which the positions of jobs in the sequence are the locations of the assignment problem. The model presents the lower bound of the problem. To compare the quality (running time) of the introduced LB, we generated some random instances of the problem from small to large sizes. The optimal solution of the small size instances is obtained through solving the developed mathematical model. To obtain the solution of the medium and large sized instances, a new simulated annealing algorithm is developed. In this algorithm, the crossover operator and mutation have been used to create a neighborhood of simulated annealing algorithm; but for the first time the crossover operator is used to create neighborhood directly. The results gained from the lower bound are compared with those of lower bound available in the literature. They confirm that the lower bound introduced in this paper gives high quality solutions, and hence, it has superiority to the available LB in the literature.

Key Words: Parallel machines, total tardiness, improved simulated annealing algorithm, mixed integer programming.

A HEURISTIC METHOD FOR THE INTEGRATED MULTI-DEPOT CONTINUOUS LOCATION-ROUTING AND INVENTORY PROBLEM

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Abstract

In this study a mathematical model has been presented for multi depots, continuous location-routing problem with inventory restrictions. In this problem, a three-echelon supply chain was assumed a factory, producing one product with unlimited capacity, is on the first echelon of supply chain. In the second echelon of supply chain, several distribution centers distribute products. In the third echelon, there is a set of customers who are scattered in different geographical locations. Location of customers is pre-specified, but distribution centers should be located. In this problem, location of distribution centers will be determined in a continuous space. As the leader of this supply chain, factory is looking for product distribution planning to minimize the total cost of this system. Model formulation of this problem is NP-hard; so a meta-heuristic algorithm with three phases has been developed for medium and large sizes of this problem. In the first phase of this algorithm, Region-rejection approach and modified saving algorithm are used to generate initial solution. In the second phase, we apply the Weiszfeld algorithm in order to improve location-routing decisions repeatedly. In the last phase, diversification and intensification mechanisms are incorporated into the search.

The proposed algorithm is able to improve even the best solution implemented by GAMS solver with time limits of 10800 seconds and 18000 seconds, 0.62 percent in average, with much less computational effort. Also it can be seen that this algorithm is moving toward the best solution during three phases. For this small sized problem, each of the three main phases, the average percentage deviation from optimal solution is only % 0.07, % 0.05, % 0.03 and medium and large size of this problem, % 2.83, %1.89 and %1.29 improvement can be seen in each phase compared to the previous phase, respectively. This improvement is impressive for the large size of this problem.

Key Words: Continuous facility location, vehicle routing, three-echelon supply chain, location-routing and inventory problem.

A STABLE REACTIVE APPROACH TO ONLINE SCHEDULING FOR FLEXIBLE FLOW SHOP SYSTEM WITH ACCEPTANCE OR REJECTION OF UNEXPECTED ORDERS

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innovation, in most of the topics of risk management this weakness in the present article has been solved.

Key Words: Risk ranking; FMCDM; fuzzy AHP; fuzzy DEMATEL.

A SUPPLIER SELECTION MODEL FOR FRAMEWORK AGREEMENTS WITH REGARD TO THE SUPPLIER DELIVERY PERFORMANCE IN HUMANITARIAN RELIEF

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Abstract

Determination of optimum comparison of suppliers with humanitarian supply chain criteria is a main challenge to relief organizations. Although the investigations in this area have ignored the delivery reliability of suppliers up to now, this parameter has a significant effect on humanitarian supply chain performance. In this paper, a mathematical model regarding delivery performance and delivery reliability of suppliers for selecting suppliers of relief items is proposed. The proposed model is formulated in a framework agreement format. We employed time window to deliver the essential items for the purpose of considering the supplier reliability. Also, we assumed that the distribution time of delivery lead time is Gaussian distribution. In the presented numeric example, the value of cost function is increased, but with considering the supplier reliability parameter, the expecting behavior of system becomes more stable. In fact, this increment of cost function is a payoff for increasing the reliability of system. The main goal of the model is to select the optimal combination of suppliers and allocation items in different scenarios. So, in the proposed model, this goal is achieved with higher quality. The real case study of selecting water suppliers in Mazandaran province of Iran with real features and scenarios is considered to evaluate the performance of the presented model. To perform the experiments accurately, we did sensitivity tests on our model's parameters, and also we investigated the scalability of the proposed model.

Key Words: Supplier selection, framework agreement, humanitarian supply chain, delivery performance, delivery reliability.

DEVELOPMENT OF A NEW INTEGER PROGRAMMING MODEL AND A LOWER BOUND FOR IDENTICAL PARALLEL MACHINES PROBLEM WITH TOTAL TARDINESS CRITERION MINIMIZATION

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Abstract

Determining effective scheduling in operations sequence is among the important problems of production scheduling. This paper deals with the problem of minimizing total tardiness on a parallel machine with N jobs and m machines. In the literature, there is a lack of suitable mathematical programming of the problem. Hence, this paper presents a mixed integer mathematical model for the problem. Since the problem has been proved as an NP-hard problem, it would be valuable to give a lower bound (LB) with a reasonable computational time. Denoting the processing time of a typical job on the machine, the modified processing time would be .With this modified processing time, the problem can be seen as a single machine; namely, the original processing time is divided by the number of machines and the division is

SIMULTANEOUS PICKUP AND DELIVERY

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Abstract

Many oil and gas producers operate offshore installations that need regular supplies of commodities from land. Specialized offshore supply vessels are used to bring supplies from onshore supply depots out to offshore installations. To achieve a cost-effective supply service, a good planning of supply vessels is required. The supply vessel planning problem is a maritime transportation problem consisting of determining the optimal fleet composition of offshore supply vessels and their corresponding weekly voyages and schedules. Traditionally, the vehicle routing problem is a pure delivery or pickup problem. In many practical situations, however, the vehicle is often required to simultaneously drop off and pick up goods at the same stop points. The objective of the problem is to develop a set of routs to service all customers while minimizing total distance travelled. In addition, some constraints, such as capacity or total durations, must not be violated. In vehicle routing problem with pickup and delivery, customers are divided into two sets. The first set is linehaul customers, each requires pickup goods; the second set consists of customers who require delivery goods. The crucial assumption in this problem is that all delivery customers must be visited before pickup customers. In vehicle routing problem with simultaneous pickup and delivery, all customers' need pickup and delivery goods.

In this study, in order to obtain an optimal supply vessel planning and propose an efficient model, which is well-adapted to the real- life situations, some additional properties, such as simultaneously pickup and delivery, are considered. In addition, an exact method consisting of two phases is presented.

Key Words: Maritime transportation, oil and gas upstream logistics, fleet composition, periodic routing, ship routing and scheduling, simultaneous pickup and delivery, tabu search.

REPRESENTING A MULTI-ATTRIBUTE FUZZY AHP AND FUZZY DEMATEL APPROACH IN ORDER TO RANK RISK EFFECTIVE FACTORS IN POWERHOUSE PROJECTS

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Abstract

Anxiety for incorrect risks management is the most important obstacle to the development of investment projects. Risk management is the most important part of project management in organizations discussed below, and there is not systematic structural approach to the risk assessment in this study, we use a combination model of Fuzzy Analytic Hierarchy Process (FAHP) and Fuzzy Decision-making Trial and Evaluation Laboratory(FDEMATEL) method to rank and valuate risk factors in Power Plant Projects. Firstly, the risk factors of construction projects are figured out through literature review and expert interview in the second step, the main criteria and sub-criteria are weighted using fuzzy hierarchical analysis is in the third stage, interrelationships among risk factors are calculated by fuzzy DEMATEL. The results of the research identifying causal factors can determine the main risk factors in the powerhouse projects. The populations of the investigation are managers and experts in the field of research. Eleven experts being familiar with construction project management are selected using judgmental sampling. In this study, for the investigation of the distribution of the type of data, Kolmogorov- smirnov test has been used. The prioritization of these factors show that among the main criteria for research, implementation and construction achieved the highest rank, and other factors are important in the next position. Also, among the 53 subcriteria research, increasing construction costs, the lack of skilled labor, confiscation of property, and land ownership hold the highest priority and are of utmost importance in the standpoint of respondents. The implementation and construction of risk have the first rank., Also, have the highest weight and have the highest interaction with other criteria by DEMATEL in terms of

the efficiency of the inner active insurance companies, this is one of the major necessities of any country. In addition, over the last decade, Iran insurance industry has implemented significant changes including the involvement of private sector in this industry and departure from government domination. These developments also clarify the necessity and importance of using appropriate methods to assess the effectiveness of different organizational levels. The purpose of this study is to design a comprehensive framework to combine the balanced scorecard (BSC) and data envelopment analysis (DEA) approaches for evaluating performance of insurance companies. The advantages of the proposed model are its weighted evaluation and maintenance of the balance among BSC perspectives, providing a holistic view and flexibility in involving factors and its outstanding power in detecting the efficient and inefficient units. In this study, first by studying the documents and interviewing with experts in insurance industry, the most important performance indexes in four areas were determined based on BSC method, i.e., financial, customer, internal processes, and learning and growth. Subsequently, by applying the DEA technique, the efficiency of a sample of 18 private Iranian insurance companies was measured. The results of the proposed model indicate that the performance of the aforementioned companies is quite satisfactory through BSC perspective. Also, in the performed aggregated ranking, the companies, i.e., Parsian, Arman, and Sina, obtained the highest scores, respectively. Ultimately, using the generated performance scores (in each area of BSC), after determining the reference groups, the optimal solutions for improving the efficiency of the inefficient companies were determined.

Key Words: Performance evaluation, balanced scored card (BSC), data envelopment analysis (DEA), insurance companies.

A MODEL FOR KNOWLEDGE-SHARING OPTIMIZATION IN A NEW PRODUCT DEVELOPMENT PROJECT TEAM FORMATION

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Abstract

As the rate of business change continues to accelerate, organizations face challenging situations like rapid technological developments, corporate restructuring, emerging technologies, and globalization. Hence, the use of project teams in the performance of daily activities is increasingly gaining popularity among many new product development (NPD) projects. Project teams are highly advantageous, because the team members share common project goals and handle technical complexity and change with the assistance of their collective cross-functional knowledge. Additionally, these cross-functional teams are often temporary organizations that are able to respond quickly to changing environmental conditions by adjusting the composition of the team members. In addition, by the use of cross-functional project teams, organizations attempt to improve coordination and integration, span organizational boundaries, improve timing of technology developments, and reduce uncertainty levels.

However, a significant challenge remains for project managers or other decision-makers to assemble project teams that are able to effectively preserve acquired knowledge during project lifecycle by project team members. Usually, three types of knowledge sharing take place in such projects: 1) knowledge sharing among team members in their domain of expertise; 2) knowledge sharing between team members and their co-workers in related functional departments in the domain of expertise; 3) knowledge sharing between team members and their co-workers in related functional department in the domains of non-expertise. Therefore, the problem of selecting proper project team's members is formulated in this paper as a mixed-integer nonlinear programming (MINLP) model to optimize these three types of knowledge sharing. We used the model for selecting a NPD project team in automotive industry. The experimental results indicated that the proposed approach is effective in selecting proper members based on their expected performance in knowledge sharing in and outside the project team.

Key Words: Knowledge sharing, project team, new product development, mathematical modeling.

OPTIMAL FLEET COMPOSITION AND PERIODIC ROUTING IN OFFSHORE SUPPLY CHAIN WITH

ability of the proposed algorithms for solving the model in medium and high dimensions. Finally, we consider the time and quality of solutions; the two algorithms are compared both graphically and statistically. The graphical comparison shows that genetic algorithm is relatively better than particle swarm optimization algorithm; and the statistical comparison between two metaheuristic algorithms shows that there is no different between genetic algorithm and particle swarm optimization algorithm in solving the proposed mathematical model. It is shown that, with the help of a numerical example and with respect to the maintenance in the model, the total system costs are significantly reduced.

Key Words: Make to stock; make to order; maintenance activities; genetic algorithm;, particle swarm optimization.

OPEN INVENTORY ROUTING PROBLEM CONSIDERING FUEL REDUCTION, SOLVING METHOD: DIFFERENTIAL EVOLUTION ALGORITHM

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Abstract

Global warming is one of the biggest challenges of industries and organizations. Greenhouse gas emissions are the main cause of global warming. One of the major sources of GHG emissions is transportation equipment. In addition, it plays a major role in the production of these gases due to logistics and transportation activities. Since inventory routing problem solves the vehicle routing problem and inventory levels simultaneously, it has a significant role in reducing costs. So to obtain a model to minimize the cost of fuel for this problem is important. Furthermore, in many distribution companies, vehicles are rented, and there is no need to return to the depot after discharge. In cases where companies do not own a vehicle fleet, or their private fleet is in satisfactory for fully satisfying customer demand, distribution services (or at least a part of them) are either entrusted to external contractors, or assigned to a hired vehicle fleet. In these cases, vehicles are not required to return to the central depot after their deliveries have been satisfied. The above- described distribution model is referred to as the Open Vehicle Routing Problem (OVRP). Therefore, the goal of the OVRP is to design a set of Hamiltonian paths (open routes) to satisfy customer demand. In this paper, a model is provided for inventory routing problem by considering the reduction of fuel consumption and reduction of the costs of inventory, driver and using vehicles in a limited planning horizon. To solve this problem, a combined improved metaheuristic method, based on Differential evolutionary algorithm and constructive Clarke and Wright algorithm, is presented. To validate the proposed solution, in the small size, the proposed algorithm was compared with the exact solution for several problem instances. In the large size, the proposed algorithm was compared with the base algorithm. The result confirms the good performance of the proposed algorithm.

Key Words: Microscopic emission models, vehicle routing problem, inventory costs, clarke and wright, differential evolutionary algorithm.

DESIGNING A MODEL FOR PERFORMANCE EVALUATION AND RANKING OF INSURANCE COMPANIES BY INTEGRATED BSC-DEA METHOD

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Abstract

In today's competitive environment, performance evaluation plays an important role in developing better strategic plans and improving efficiency of any organization. Due to the importance of insurance industry in socioeconomic growth and development of societies, it is notable to take into account the fact that the improvement in efficiency and effectiveness of the industry relies on

Abstracts of Papers in English

A MATHEMATICAL MODEL IN HYBRID MAKE TO STOCK AND MAKE TO ORDER ENVIRONMENTS WITH MAINTENANCE ACTIVITIES AND ITS SOLUTION BY META-HEURISTIC ALGORITHMS

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Abstract

In this paper, we present a mathematical model in Make to Stock (MTS) and Make to Order (MTO) production environments in order to entry stage. By solving this model, price and lead time of orders will be favorably obtained with respect to the maintenance activities. Also, in this study, scheduled preventive maintenance on assembly resources will be characterized. The proposed mathematical model is a mixed integer linear programming model. After presenting mathematical model, solving methods and various numerical examples in different dimensions are given. To solve the proposed model, at first, we use an exact method. The exact method is applied by optimization software, namely lingo 8.0. After solving the proposed model by Lingo 8.0 software, the results show that lingo software is not able to solve the model in medium- and large- sized problems in a reasonable time. The proposed model is classified among the NP-hard problems. In NP- hard problems, by increasing dimension of problems, the time taken for solving the models increases exponentially. It is also appropriate for our model. For solving NP-hard problems at the appropriate time, the metaheuristic algorithms are applied. Therefore, for solving the proposed model in medium and high dimensions, two meta-heuristic algorithms, namely genetic algorithm (GA) and particle swarm optimization (PSO) algorithms have been used. The comparison between the meta-heuristic algorithms and output of Lingo 8.0 software shows that the suit-