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Multi-objective production planning model for equipment manufacturing enterprises with multiple uncertainties in demand

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ABSTRACT

A production planning model with multiple uncertainties was established in this paper. Customers' demands for quantity, quality, delivery time and price are different. For an ambiguous number of customers, the expectation of the degree of satisfaction was determined by a triangular fuzzy number method. A trapezoidal fuzzy number method was used for customer prices to determine the expectation of satisfaction of the delivery date. Fuzzy intervals and interval numbers were used to describe quality uncertainty and price uncertainty, respectively. A multi-objective planning model was established, which consists of four objectives, namely, meeting customers' needs, minimizing costs, minimizing delivery time and maximizing corporate profits. Then, the non-dominated sorting genetic algorithm (NSGA-II) was implemented to simulate and solve the problem of uncertain optimization. This modal resolved multiple uncertainties in customer demand during the process of production planning for the equipment manufacturing enterprises. The results of the running showed and generated a series of Pareto solutions, which are consistent with the results of a multi-objective planning solution. Manufacturers can obtain the best production plans according to the company's production objective priority rules. Finally, the adaptability and feasibility of the model were verified.

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Keywords:
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Izvirni znanstveni članek

Večkriterijski model za načrtovanje proizvodnje za proizvajalce opreme z negotovimi zahtevami

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POVZETEK

V članku je opisana vzpostavitev modela načrtovanja proizvodnje z več negotovostmi. Zahteve strank glede količine, kakovosti, dobavnega roka in cene so različne. Za nedoločeno število kupcev je bila pričakovana stopnja zadovoljstva določena z metodo mehkih trikotnih števil. Za določitev pričakovanega zadovoljstva glede dobavnega roka, je bila pri cenah za stranke uporabljena metoda mehkih trapeznih števil. Za opis negotovosti glede kakovosti in cene so bili uporabljeni mehki intervali in intervalna števila. Vzpostavljen je bil večkriterijski model načrtovanja, ki ga sestavljajo štirje kriteriji, in sicer zadovoljevanje potreb strank, zmanjševanje stroškov, skrajšanje dobavnih rokov in povečanje dobička podjetij. Za simulacijo in reševanje problema negotove optimizacije je bil uporabljen genetski algoritem z nedominiranim sortiranjem (NSGA-II). Model je rešil številne negotovosti povezane z zahtevami kupcev, ki se pojavijo med postopkom načrtovanja proizvodnje v podjetjih, ki proizvajajo opremo. Rezultati so prikazani na vrsti Pareto grafov, ki so skladni z rezultati večkriterijskega načrtovanja. Proizvajalci lahko izberejo najboljše proizvodne načrte v skladu s prednostnimi pravili podjetja. Preverjeni sta bili tudi prilagodljivost in izvedljivost modela.

PODATKI O ČLANKU

Ključne besede:
Načrtovanje proizvodnje;
Številne negotovosti;
Proizvodna podjetja;
Večkriterijski model;
Genetski algoritem z nedominiranim sortiranjem (NSGA-II)

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