ABSTRACT AND REFERENCES

MATHEMATICS AND CYBERNETICS – APPLIED ASPECTS

A METHOD OF RESOLVING FUNCTIONS FOR ONE CLASS OF PURSUIT PROBLEMS (p. 4-8)

Lesia Baranovskaya

We have considered a pursuit game with one escapee and one pursuer. The managed conflictprocess is describedin the system of differentialdifference equations of a neutral type. Such equations contain an unknownfunction and its derivatives at different points of time and have not been applied in the theory of differential games yet. Effective in solving particular pursuit game tasks is a resolving functions method that is closely related to L. S. Pontryagin's first direct method and commonly used in regular differential games and differential-difference games of a delayed type. We have devised a modified method of resolving functions for differentialdifference pursuit games of a neutral type. In the pursuit process, there exists a switch-over point that starts the catch time. This proves that the escapee's errors do not affect the guaranteed time of the game end, which is calculated and set in advanceby the process parameters.The study has revealed adequate conditions for the process parameters that allow finishing the game within the fixed end time.

The class of the known differential pursuit games can be expanded by the formulated pursuit task, whose process is described in the system of differentialdifference equations of a neutral type, and the devised scheme of the resolving functions method. This facilitates further consideration of such processes in the pursuit task with non-fixed time, objects of various inertia, and integral restrictions.

Keywords: differential pursuit games, differentialdifference equations, a method of resolving functions / a resolving functions method.

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DEVELOPMENT OF A MATHEMATICAL MODEL OF A COMBINED METHOD OF CREATING THE BASIC CLOTHING DESIGN (p. 8-15)

Anna Safonova

The paper deals with the existing problems of clothing computer-aided design process. The purpose of the study is a mathematical formalization of approximate combined method of creating basic designs of templates with the following characteristics: construction requires a small number of dimensional attributes, formulas; absence of construction dependence on invariant tables; consideration of the individual characteristics of the body, anthropometry and aesthetics of the result; construction simplicity and readability of drawings; high-quality fit of the product. This method is the result of the synthesis of some approximate cutting methods, such as first calculation-measurement, proportional-calculation and anthropometric.

To achieve this goal, input data of drawing construction problem, algorithms of geometric constructions of baseline designs with specification of drawings for taking into account the individual characteristics of the body were described, and the exact coordinates of the nodal points in the coordinate plane structures to further automate the method were defined.

Keywords: design methods, combined method, basic templates, drawing construction, nodal points.

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DEVELOPMENT OF THE PROJECT DURATION REGRESSION MODEL OF PREPARING WOMEN-BOXERS TO COMPETITIONS (p. 16-20)

Sergiy Prykhodko, Nataliya Knyaz

The regression model of the duration of the projects of preparing women-boxers to competitions based on training duration was considered. The aim of the research is developing of non-linear project duration regression model of preparing women-boxers to competitions based on training duration using Johnson transformation. The empirical data of training duration and empirical data of duration of preparing to women boxers to competitions were analyzed using mathematical statistic methods. The regression model was developed based on Johnson transformation using regression analysis methods. Regression model development approach based on Johnson transformation vs. approach based on common logarithmic transformation was compared. Non-linear regression model of duration of projects of preparing women boxers to competitions based on Johnson transformation have better characteristics than the model based on common logarithmic transformation. Therefore, the application of regression model based on Johnson transformation for duration estimation of projects of preparing women-boxers to competitions was recommended. At the present stage the research is the actual because it will enhance the effectiveness of training women-boxers to competitions because it will improve sportsmanship of boxers and enable them to achieve better results in competitions.

Keywords: time management, Johnson transformation, regression model, logarithmic transformation.

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A SYSTEMATIC APPROACH TO THE SYNTHESIS OF FORECASTING MATHEMATICAL MODELS FOR INTERRELATED NON-STATIONARY TIME SERIES (p. 21-35)

Vitalii Shchelkalin

The study presents a schematic diagram suitable to describe almost any presently known combined, hybrid or decomposition model for forecasting time series. The diagram has laid the basis for the suggested methods of structural identification of sparse nonlinear models of interrelated non-stationary time series on the basis of "Caterpillar"-SSA methods, fast orthogonal search, a group accounting method, and SARIMA models.

Often a plurality of measured features is insufficient for building a model of satisfactory quality. It is necessary to extend the set of features by means of functional transformations of initial signs to decrease the uncertainty of the linear model. The study suggests that components of the "Caterpillar"-SSA method expansion, applied to the forecast and exogenous time series, should be viewed as generated variables.

In one of the suggested models, the method of fast orthogonal search is used for optimal thinning. In the other––the method of group arguments accounting is applied to thin the Kolmogorov-Gabor polynomial, which is built on the expansion components of the "Caterpillar"-SSA method that is applied to the forecast and exogenous time series. To correct the forecasts in both models, we used the seasonal model of auto-

regression – the integrated moving average. The analysis and modeling of the considered method prove its effectiveness in the search of an optimal model structure, and the time for determining the model parameters considerably shortens alongside.

Therefore, a systematic approach is a set of methods and tools that facilitates overall researching of the properties and structure of the interrelated non-stationary time series and presents them as systems with all complex inter-element relationships.

Keywords: forecast, structural identification, the "Caterpillar"-SSA method, the method of group arguments accounting.

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AN ANALYTICAL GEOINFORMATION SYSTEM FOR OPERATIONAL PLANNING OF THE TRAFFIC ROUTES OF GARBAGE TRUCKS (p. 36-42)

Andrei Tevyashev, Olga Matviienko, Oleg Shiyan

The article considers an effective approach to solve the problem of operational planning and monitoring of the traffic routes of garbage collectors in settlements on the basis of an analytical geoinformation system. The system structure is presented as three interrelated subsystems: geoinformation, analysis, and monitoring. We have suggested a mathematical formulation of the problem of effective planning of the traffic routes of garbage collectors and an efficient algorithm of solving it. The planned routes are controlled by the subsystem of monitoring vehicles that uses GPS-navigation.

Implementation of the analytical geoinformation system for effective planning of the traffic routes of garbage trucks is

an efficient means to improve environmental security as well as housing and utility energy and resource economy.

Practical implementation of the devised plan of detailed routes for the removal of municipal solid waste allows reduction of the required number of garbage trucks (from three to two), cutting the total length of their routes, and decreasing by 35 % the actual fuel costs for the planned period of one month.

Keywords: refuse collection vehicle/garbage truck, optimization, route, energy economy/energy saving, GPS-navigation, municipal solid waste.

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DEVELOPMENT OF SIMPLIFIED MATHEMATICAL MODEL OF GLASS MELTING FURNACE (p. 42-47)

Anatolii Zhuchenko, Vitalii Tsapar

A simplified mathematical model of the glass melting furnace, constructed based on the method of separation of variables (Fourier method) was proposed in the paper. This method allows to simplify the computational procedures and evaluate the approximation error. To construct a simplified model, basis vectors and Fourier coefficients were determined. The optimal basis vectors are determined from the minimization condition of l_2-norm of the corresponding error vector from all orthonormal bases of the n-th order. l_2 norm of the error vector is minimized by maximizing the limited vector of Fourier coefficients. Determination of Fourier coefficients was performed by system identification. In order to study the quality of a simplified mathematical model of glass melting furnace, the simulation was carried out. As input variables, fuel feeds to 3 burners were used. The values of input variables were formed as a sequence of pseudo-random binary signals. Analysis of the results indicates a high enough accuracy of the simplified mathematical model. The largest model errors occur at relatively high rates of temperature change.

Keywords: glass melting furnace, Fourier method, orthogonal decomposition, system identification, state space.

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MULTI CRITERIA OPTIMIZATION OF HUMAN RESOURCE MANAGEMENT PROBLEMS BASED ON THE MODIFIED TOPSIS METHOD (p. 48-62)

Masuma Mamedova, Zarifa Dzhabrailova

With the development of an innovative economy, human resources are transformed into the main strategic resource, providing long-term competitiveness and achievement of the organizational goals. Therefore, developing new conceptual approaches and promising technologies of human resource management is of particular relevance and practical significance.

The paper highlights the specific features of human resource management (HRM) problems, allowing to identify them as the problems of multi-criteria analysis and decision-making in a fuzzy environment. A generalized conceptual model of decision-making in HRM problems was proposed. It is proved that for increasing the efficiency and transparency of decisions in the human resource management, using multi-criteria optimization based on the TOPSIS method is appropriate, and the advantages of the latter were shown. A TOPSIS modification, which lies in integrating an additional component that provides a calculation based on the hierarchy analysis method of expert competence coefficients into the decision-making algorithm was proposed. Using the methods of TOPSIS and scor-

ing on the example of the employment problem, experimental calculations for ranking alternatives, having demonstrated the effectiveness of the proposed approach were carried out.

Keywords: management, human resources, decision making, fuzzy environment, intelligent technologies, multi-criteria optimization.

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EVALUATION OF IMPORTANCE OF FIGURES BY PAIRWISE COMPARISONS WITH SCALARIZATION OF VECTOR CRITERION (p. 62-68)

Tetiana Katkova

The author draws attention to the overall design flaw of traditional methods for evaluating the importance of particular object figures, associated with insufficient adequacy of procedures for calculating the weighting factors. Traditional technologies are based on processing the expert survey results. At

the same time, experts, independently evaluating the relative importance of particular figures, rank them, and then the sum of the ranks determines the final estimate of the importance of each figure. In fact, the weighting coefficients, calculated according to the above scheme, uniquely determine only the place that was taken by the corresponding figures in the table of ranks. However, the real importance of the two figures, having taken the next places in this table may differ much more significantly than it is determined by their place. This flaw is of a general nature. In such a situation, analytic hierarchy process, based on a paired preference of one figures over the other has been used recently. The author has proposed a modified pairwise comparison procedure to assess the importance of the object quality figures. In this case, if the elements of the pairwise comparison matrix, formed based on the expert survey results, are not agreed, correction of this matrix is carried out.

Keywords: analytic hierarchy process, pairwise comparison method, weighting factors, evaluation of figures, approximate problem solution.

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