

DEVELOPMENT OF MATHEMATICAL MODELS OF FUZZY CONTROLLERS SET BY GENETIC ALGORITHM TO STABILIZE DYNAMIC OBJECT

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Abstract. The paper presents mathematical models of two fuzzy controllers used to stabilize dynamic object (e. g. statically unstable aircraft in pitch channel). The controllers are different in structure and operating principle. They are set using the genetic algorithm. The first controller is based on the training set, the second – on the rules of fuzzy arithmetic. The design algorithms and mathematical models of the controllers are provided. The structure and operating principle of the genetic algorithm used to set the parameters of the fuzzy controllers of both types are described. The tests were conducted to study the behavior of the developed genetic algorithm in various modes; the best combinations of the controller parameters values were determined. The work also covers the result of mathematical modelling of the attitude control system operation with the proposed types of fuzzy controllers after setting, when the aircraft is affected by random perturbations. The attitude control system equipped with the designed controllers showed better speed of response as compared to the conventional control system. The proposed approach to design fuzzy controllers is recommended to solve the problems of stabilization of the non-linear unstable dynamic object with the switching of the control modes.

Keywords: dynamic object, fuzzy controller, PID controller, genetic algorithm, stabilization system, pitch channel, statically unstable aircraft.

PERFECT POLITICIAN FOR SOCIAL NETWORK: AN APPROACH TO ANALYSIS OF IDEOLOGICAL PREFERENCES OF USERS

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Abstract. In this paper, we consider the problem of determining politico-ideological preferences of users of online social networks. We propose a model (DLS model) that allows assessing politico-ideological preferences of VKontakte users using information from their accounts (digital footprints). The model meets the main ideological directions in modern-day Russia. Our approach is based on the supervised learning methodology whereby one solves a classification problem by calculating posterior probabilities of class membership. We make an anonymized labeled dataset and develop corresponding software. Then we formulate and solve the problem of the politician's choice of an ideological positioning strategy, that will potentially receive the most support from the considered set of users. We exemplify our methodology by finding «ideal» political positioning for some popular online communities in VKontakte.

Keywords: online social networks, ideological views, DLS-model, big data, finding the optimal ideological position.

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COMPETITIVENESS MANAGEMENT IN THE DIGITAL PLATFORM SYSTEM

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Abstract. It is shown that digital platforms modify the existing mechanisms of competition and actively managing their competitiveness. A detailed classification of digital platforms is developed. Mechanisms for managing the competitiveness of digital platforms were developed and represented. The development of the resource theory of systemic organization of the economy in the context of its platformization is proposed. The interconnections of digital platforms with projects for the introduction of competitiveness management mechanisms are determined. The connections of digital platforms with the environment system of resource providers for the platform and consumers of its services, as well as with the pricing system in the markets of these resources and services – as the basis for assessing changes in the interaction of demand and supply were developed. The possibility of introducing adequate mathematical modeling is suggested in order to improve the management efficiency of this competitiveness. At the same time, a variety of relationships was taken into account when modeling management mechanisms to increase competitiveness, which will significantly reduce the risks of implementing these mechanisms and increase the efficiency of using digital platforms.

Keywords: competitiveness, digital economy, digital platform, digital ecosystem, classification, management.

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CONSTANT BEHAVIOR IN RESOURCE ALLOCATION GAMES: RESISTANCE TO THE GAME DESIGN, AND THE MODEL

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Abstract. In the conducted resource allocation games, «constant» behavior (CB) of the players was found when the players do not change their bids during several steps of the game. A feature of the game data is that the CB occupies a large share in them. A modified design of the games is proposed, where payments are made for each of the five game steps and the interface does not allow the player to easily enter an unaltered bid. The results of games with modified design showed that the proportion of CB has decreased, but remains at a fairly high level. The following are the results of a search for the causes of this behavior using statistical hypotheses and solving problems of classifying decisions of players. Among the statistical hypotheses, hypotheses are used about the random nature of CB and stopping CB in case of decrease payoffs. The

classification task allows the selection of informative features (parameters and history of the game) and the rule of decision-making by players (classifier) to stop the CB on the features basis. The results of constructing the classifier gave the idea of complicating the model: the player has not only the principle of stopping/continuing CB, but also the principle of starting CB. It is also shown that the results of statistical research and classification have common features and can further complement each other.

Keywords: business games, experimental economics, behavior models, resource allocation task.

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TERNARY SUM CODES FOR THE DIGITAL CIRCUIT TESTING

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Abstract. The protection of data presented in the ternary form, are discussed. The ternary logic relevance in the future is emphasized, and the main features of the reliable digital devices development and systems are identified. A ternary sum code is described that detects any monotonous and asymmetrical errors in data vectors, the use of which is promising in the devices and systems construction with fault detection. The constructing principles a ternary sum code is similar to the constructing principles classical binary sum codes (Berger codes). The previously unknown ternary sum codes properties in the event of errors only in data vectors with error-free check bits are established. Such a task is relevant in practical applications in which the check bits and data vectors are calculated by physically different devices. Taking into account the established ternary sum codes properties can be useful when choosing a method of protecting both the data itself and parrying faults arising in automation devices.

Keywords: ternary logic, device use a ternary logic, fault detection in automation devices, calculation control, data protection, ternary sum code, Berger's code, undetectable error, error detection characteristics.

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THE COMPUTER CLUSTERS WITH FAST SYNCHRONIZATION OF MESSAGES AND WITH FAST DISTRIBUTED COMPUTING BY THE NETWORK HARDWARE

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Abstract. The network structure and methods for the rapid interaction of computers in a distributed composite cluster are proposed. The composite cluster is organized hierarchically and consists of a group of simple clusters, one of which gives tasks to simple clusters. Simple clusters perform tasks synchronously and asynchronously. In the simple cluster, a group of processors also acts synchronously or asynchronously,

using fast barrier synchronization. The activities of simple cluster computers are controlled by a leading computer. The composite cluster quickly performs the processes of synchronization of messages sent, processes to resolve conflicts of computer access to network tools, distributed logical operations, the distributed definition of *max* and *min*, distributed addition and subtraction operations. These operations do not require message delay to complete. The duration of operations does not depend on the number of cluster computers participating in them. To do this, computers send messages simultaneously, creating a group message in which the bits of the same name are combined in time. Acceleration of the above mentioned distributed computing and synchronization are achieved with intensive computer access to the cluster network, which distinguishes the proposed solutions from the existing practice of using a computer network. The proposed operations allow creating faster algorithms for real-time tasks, including tasks for managing the cluster.

Keywords: computer cluster, hierarchical network structure, fast computing in the network, dynamic reconfiguration, distributed synchronization, barrier synchronization, the distributed accelerator of computing.

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EFFECTIVE CONTROL OF A HYBRID SYSTEM OF GENERATION AND DISTRIBUTION OF ELECTRICITY WHEN MOVING AUTONOMOUS UNINHABITED UNDERWATER VEHICLE

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Abstract. For the movement of an autonomous underwater vehicle (AUV) at a speed from a wide range due to the increased density of the marine environment, various actuators are used, which differ not only in the principle of operation, but also in the current consumption that varies over time. Because of this, power sources that are different in principle of action are needed. In this regard, the movement control of AUVs necessitates solving the problem of effective control of the energy generation and distribution system, which is understood as determining the necessary composition and parameters of power sources, as well as the distribution of consumers on buses under strict time limits. The purpose of the work is the development of effective control of the AUV energy generation and distribution system to ensure its movement with specified parameters. The analysis of connecting/disconnecting consumers revealed that all situations can be reduced to two types of control: the first – in which it is not known in advance which of the consumers will be connected and what current it will consume; the second - in which the composition of consumers and the amount of current consumed by them are known. To determine the management of consumer switching, the task is formalized as the task of packing in containers, for the solution of which heuristic algorithms exist. An analysis of existing algorithms in relation to the problem to be solved allowed us to determine that the Best Fit and Best Fit Decreasing algorithms provide effective control of the power generation and distribution system. An example of controlling a hybrid system for generating and distributing electricity when changing the parameters of the movement of the apparatus is given.

Keywords: autonomous underwater vehicle, hybrid power generation and distribution system, heuristic algorithm.

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