Control Processes

DOI: 10.15587/1729-4061.2021.242960

Devising a Method for the Formation of Sustainable Chains of Supply of Raw Materials from Mercantile Exchange to a Timber Processing Enterprise Considering Uncertainties and Risks (p. 6–18)

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The relevant problem of guaranteed supply of high-quality raw materials to a timber processing enterprise that does not have its own sources of raw materials is considered. A method for the formation of sustainable chains of supplying raw materials to a timber processing enterprise was proposed, taking into consideration uncertainties and risks associated with the purchase of raw materials on the mercantile exchange and the implementation of the circuit of delivery to a warehouse. A dynamic model, which is a problem of stochastic nonlinear programming, the objective function of which is the cost of purchasing raw materials, was developed. The model makes it possible to form a plan for purchasing raw materials on the timber section of the mercantile exchange on a given planning horizon, taking into consideration uncertainties when it comes to the number of daily offers, their volumes, and prices. The risk of cancellation of the concluded contract due to the loss of the quality of raw materials during delivery and non-fulfillment of delivery terms was also taken into consideration. To find a solution to the model, a two-stage circuit, in which the first stage involves a procurement plan that is close to optimal, was proposed. At the second stage, a plan that is closest to the basic one in terms of the volume of purchased raw materials and minimizing the total costs is chosen for each day of implementation of a random flow of applications. The numerical solution at the first stage is found using the heuristic algorithm that uses the branch and bound method and the genetic algorithm at certain steps. At the second stage, the multi-criteria problem of mathematical programming is solved numerically. An example of the formation by a timber processing enterprise in the Far East of a suboptimal procurement plan that ensures an increase in the efficiency and sustainability of economic activity in the long term is considered.

Keywords: supply chains, timber industry, optimization of planning of raw material procurement, stochastic nonlinear programming.

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DOI: 10.15587/1729-3774.2021.242915
DEVELOPMENT OF A SIMULATION MODEL OF A CARGO CUSTOMS COMPLEX OPERATION AS A LINK OF A LOGISTIC SUPPLY CHAIN (p. 19–29)

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The main link in the logistics supply chain is the cargo customs complex. It provides customs and logistics services to cargo owners during the export and import of goods, complex services, placement of goods in a customs warehouse and a temporary storage warehouse. To substantiate the choice of the optimal logistics supply chain and optimize the work of the cargo customs complex, it is proposed to use simulation modeling.

The model of operation of the logistics chain and the cargo customs complex is presented in a general form. The proposed model is implemented in the GPSS World simulation automation package. Testing the simulation model involved checking its adequacy. Checking the adequacy of the simulation model, which showed the maximum value of the t-statistic of 1.424 with a critical value of 1.85, proved its compliance with the work of a real object.

After completing the adequacy check, the simulation error was estimated, which was 3% with an allowable 5%, due to the presence of pseudo-random number generators in the simulation model. Thus, the simulation error is insignificant for this study.

For the cargo customs complex, an example of the simulation results is given. Based on the results of simulation modeling, it is possible to determine: the optimal type of the logistics supply chain and the optimal structure of the cargo customs complex. A wide range of tasks that the proposed simulation model can solve is presented. Thus, the developed simulation model will make it possible to analyze and improve the modes of operation of the cargo customs complex. In addition, it will allow to get an informed decision regarding the use of a certain type of logistics supply chain.

Keywords: logistics chain, simulation model, cargo customs complex, vehicle.

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DOI: 10.15587/1729-4061.2021.241487
OPTIMIZATION OF THE STAGES OF A SHIP’S CARGO PLAN DEVELOPMENT FOR SHIPPING OF GENERAL CARGOES (p. 30–36)

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One of the main tasks in stability calculations is to provide the ship with the necessary (optimal) trim whose final value is influenced by the arrangement of cargo on the ship. Today, however, there are rules and requirements but there is no unified approach to developing a cargo plan for a vessel that simultaneously transports various types of general cargos.

In order to improve the efficiency of the above calculations, a procedure has been proposed to optimize developing a cargo plan for a vessel carrying heterogeneous general cargoes at the same time, the main idea of which is to distribute consignments on the ship in two stages, taking into consideration the compensating trimming moment. The scheme to develop a cargo plan has been improved by introducing the developed procedure. The results of verification confirmed its effectiveness in practice.

Possible deviations of the values for the trim required (optimal) for the voyage from the actual one calculated after the allocation of stocks and consignments of goods have been investigated using an example of the series of developed cargo plans. It should be noted that the value for the trim, required (optimal) and actual, for each individual cargo plan does not differ by more than 8%.

The results reported in this paper give grounds to assert the expediency of their application when developing cargo plans for tramp shipping vessels. The introduction of the procedure could make it possible to effectively load a vessel with the full utilization of both its carrying capacity and cargo capacity. The use of the proposed scheme for developing a cargo plan to transport heterogeneous cargos would reduce the total time for calculating the stability and strength of the vessel in general.

Keywords: cargo plan, trim, general cargo, trimming moment, stability of the vessel.

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The widespread introduction of information technologies in the systems that manage technical fleets, the use of maintenance and repair systems based on risk assessment, is based on the calculation of a large enough number of indicators. Modern locomotives are equipped with systems for monitoring and diagnosing technical condition. Combining these systems with the Internet of Things and Big Data technologies provides an opportunity to use completely new approaches to fleet management. At the initial stage of the construction of such systems, it is necessary to devise criteria that make it possible to automatically determine the technical condition of a locomotive and its components in order to identify the locomotive in the total fleet that requires maintenance or repair.

A procedure has been proposed for calculating the technical condition index of locomotives and their components based on data from monitoring systems. The procedure is based on the formation of latent diagnostic parameters employing the principal component method and on the subsequent calculation of the weight coefficients of these parameters applying the method of hierarchy analysis. The special feature of the proposed procedure is that when calculating the index, those latent diagnostic parameters are used that are derived from the group of control parameters whose weight coefficients are computed using the method of hierarchy analysis without involving experts.

This paper reports the results from calculating the informativeness of the diagnostic parameters of load, loss, input, as well as their weight coefficients. The highest information content, from 0.5 to 0.85, is demonstrated by the load parameter; the smallest (0.05–0.26) – the input parameter. The average value and the dependences of changes in the technical condition index of a hydraulic transmission during the tests have been determined. Analysis of the technical condition index makes it possible to assess the transmission’s response to changes in test modes, the dynamics of changes in losses.

**Keywords:** technical condition index, informativeness, diagnostic parameters, principal components, hydraulic transmission.

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**DOI:** 10.15587/1729-4061.2021.242478
Devising an Integrated Method for Evaluating the Effectiveness of Projects in the Field of Information Technology (p. 46–53)

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An integrated method for evaluating the effectiveness of projects in the field of information technology has been proposed, which could ensure effective management decision-making. All features inherent in the implementation of the Scrum methodology used in the management of information technology projects have been taken into consideration. Ambiguous situations that constantly arise during the implementation of projects affect their effectiveness. Therefore, constant monitoring of the project efficiency would provide opportunities for the project manager to make management decisions promptly, which could contribute to improving the effectiveness of the project. The integrated method for evaluating the effectiveness of projects was devised in the class of organizational-technological systems based on the combined use of formalized, intelligent, and expert methods. The results of applying a given method include an increase in the project efficiency by 1.52% by complying with time limits, a reduction in the over-spending of financial resources and losses during the project, as well as the improved productivity of teamwork.

A model of the project efficiency index has been devised, which would ensure taking into consideration the peculiarities of the organizational and technological components of the project, as well as establishing a logical connection between the criteria that characterize the organizational component of the project, on the one hand, and the project-technological component, on the other. The resulting project efficiency index contributes to further research of various alternative scenarios for the project implementation and forecasts the dynamics of achieving strategic goals, as well as the dynamics of project implementation.

The proposed procedure for evaluating the effectiveness of the project under Scrum conditions could become the basis of the information technology of project management and the appropriate decision support system.

Keywords: integrated method, evaluation, efficiency index, organizational and technological components.

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DOI: 10.15587/1729-4061.2021.239854

DEVELOPMENT OF OBJECT STATE ESTIMATION METHOD IN INTELLIGENT DECISION SUPPORT SYSTEMS (p. 54–64)

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A method of object state estimation in intelligent decision support systems (DSS) has been developed. The essence of the method is to ensure a high-quality analysis of the current state of the analyzed object. The key difference of the developed method is the use of an advanced genetic algorithm. The advanced genetic algorithm is used when constructing a fuzzy cognitive model and increases the efficiency of identifying factors and relationships between them by simultaneously finding a solution by several individuals. The objective and complete analysis is achieved using advanced fuzzy temporal models of the object state, taking
into account the type of uncertainty and noise of initial data. The method also contains an improved procedure for processing initial data under a priori uncertainty, an improved procedure for training artificial neural networks and an improved procedure for topological analysis of the structure of fuzzy cognitive models. The essence of the training procedure is the training of synaptic weights of the artificial neural network, the type and parameters of the membership function, as well as the architecture of individual elements and the architecture of the artificial neural network as a whole. The method increases the efficiency of data processing at the level of 11–15% using additional advanced procedures. The proposed method can be used in DSS of automated control systems (artillery units, special-purpose geographic information systems). It can also be used in DSS for aviation and air defense systems. The proposed method can be used in DSS of automated control systems (artillery units, special-purpose geographic information systems). It can also be used in DSS for aviation and air defense systems.

Keywords: decision support systems, artificial neural networks, genetic algorithm.

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This paper proposes an algorithm to substantiate the need for weapons samples, as well as targeting when using a reconnaissance firing system taking into consideration the peculiarities of functioning of such systems. The algorithm essentially implies streamlining the stages in determining the magnitude of the reduction of the enemy’s combat potential and, on its basis, the formation of the need for the number of weapons by type. The algorithm makes it possible to take into consideration the non-linearity of functions that describe both different types of weapons and targets. In addition, this algorithm is based on a modified method of nonlinear programming (two functions). The modification involves the use of a normalized share of the weight of each target as weight coefficients. This allows for targeting while taking into consideration the established level of the combat potential of an enemy.

A procedure for determining the need for samples of weapons and targeting in the use of reconnaissance firing systems has been devised. It was determined that in order to achieve the goal of enemy fire damage, it is not typically necessary to use all weapons samples. In general, the procedure makes it possible to take into consideration the peculiarities of the samples of weapons and their suitability to hit a certain target. That could prevent problems with overspending of resources, failures in the detection-defeat cycle, non-fulfillment (not fully performing) tasks during enemy fire damage.

In general, the algorithm and procedure for determining the need for weapons samples and targeting when using a reconnaissance firing system testify to devising a methodology for justifying the need for weapons samples and targeting and obtaining the result confirmed by the experience in the use of reconnaissance firing systems.

Keywords: reconnaissance firing systems, methods of nonlinear programming, method of two functions, combat potential.

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DOI: 10.15587/1729-4061.2021.242688
IMPROVING A METHOD FOR DETERMINING THE MANEUVERING INTENSITY OF THE EXECUTIVE ELEMENT OF A SPECIAL-PURPOSE SYSTEM (p. 75–83)

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The purpose of improving a method is to devise a tool for resolving contradictions in the practice of conflict events related to increasing the survivability and effectiveness of participation in a conflict event. A method for forecasting the survivability indicators of a special-purpose system based on the method of analytical-stochastic modeling of a conflict event was chosen as the basis for improvement. The improved method is intended to find a compromise between the need to increase the duration of participation in the conflict and minimize the time of being at risk of loss of ability to function.
The use of the improved method, unlike the existing ones, provides an assessment of the impact of maneuver on the effectiveness of the implementation of tasks and the survivability of SPS. The method implies justifying the techniques for the executive elements to maneuver in order to create favorable conditions and effectively perform tasks in a conflict event.

The method involves the procedure for the formation of initial data; determining the maneuvering intensity of executive elements; comparing the parameters for expedient (rational) and implemented maneuvering techniques; the generalization of the research results.

The accepted indicators of the effectiveness and survivability of a special-purpose system in a conflict event are the mathematical expectations of the number of destructive influences and the number of preserved executive elements as a function of the intensity of maneuvering. The criteria defined for assessing the maneuvering techniques are the greatest values of the increase in efficiency and survivability with the change in the intensity of maneuvering and taking the favorable position by an executive element in a conflict event.

The specified method has helped investigate the peculiarities of changing performance and survivability indicators dependent on the intensity of maneuvering and determine the criteria signs for selecting maneuvering techniques.

Based on the signs of informativeness and the nature of the mutual influence of the relevant indicators, the advantage of the method is 30% while the objectivity of taking into consideration significant factors increases by 15%.

Practice needs to predict the consequences of processes of conflicting nature on the grounds of the effectiveness and survivability of its participants.

Keywords: forecasting method, maneuvering techniques, evacuation, survivability indicators, conflict event.

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DOI: 10.15587/1729-4061.2021.243298

DEVELOPMENT OF SYSTEM FOR SELECTING SUITABLE LANDING LOCATION INSIDE THE LOCAL HAZARD AREA (p. 84–91)

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In the area of successful landing and guidance of the aircraft on the route, flight safety is perceived as the highest rate of observation of all operational-control functions of the aircraft. The given functions of the aircraft are observable and identifiable by the systems and cognitive perceptions of the pilot. Situational control of the aircraft on the route with the identification of the danger, into which the pilot can get is perceived as an exact element of failure. If the pilot enters such a situation, apriori solutions are offered to him/her by the aircraft information system. The character and emergency solution in the highest criticism of the failure of aircraft systems is the controlled landing in the local safety corridor when guiding the aircraft on the selected route. The aim of the article is the theory of the solution for the introduction of an assistance element in small aircraft with a description of the solution of autonomous choice of geolocation in a defined local environment. By a heuristic experiment in the article, let’s prove the methods of selection of geographical areas.
for landing an aircraft with the possibility of introduction into the aircraft information system. The article presents the methodology of creation autonomous assistance system based on the measurement of detection areas for landing with the collection of data from the GIS system. This system can assist in pilot training and real flights for small aircraft without difficulty. The effectiveness of such system and the parameterization of its data were shown and proved. The developed models may be further used for creation an autonomous selection system in the event of accidental aircraft failures.

**Keywords:** emergency situation, suitable geolocation, assistance system, flight area, efficiency criteria.

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**DOI:** 10.15587/1729-4061.2021.237583

**Devising a Method to Control the Operational Quality and Reliability of Fiber-Optical Communication Lines (p. 92–100)**

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The lack of recommendations in the normative and technical documentation related to fiber-optic communication lines (FOCL) for assessing their technical condition necessitated devising a method to control the lines’ quality and reliability of operation.

The method creates the basis for calculating the quality and reliability indicators of FOCL operation and suggests measures to improve them. It determines the methods of control, as well as the acquisition, accounting, and analysis of damage statistics with and without interruption of communication.

The graphic sequence of implementation of the stages of the method demonstrates that resolving the task to control these indicators should involve:

- managing the acquisition and actual acquisition of operational data on damages (the causes, nature, quantity, the duration of communication breakdown and complete elimination of damage);
- determining the quality and reliability indicators of FOCL operation annually;
- analysis of the obtained results and the development (correction) of measures to comply with the norms of these indicators;
- the implementation of measures to comply with the norms of quality and reliability of FOCL operation (if necessary).

Based on the operational data from a line operator acquired over three years in the specified climatic zone (a cable of the type OKL.Bg-3 DA12-3×4E-0.4F3.5/0.22N18-12/0), the methodological component of the method was examined.

The obtained results on the operational quality (damage density, average damage duration, break (downtime) of communication) and reliability indicators (FOCL readiness factor) of a subscriber access network without reservation showed that the line had low efficiency. The communication breakdown over three years amounted to K=12,569.8 stream-hours. The downtime at this volume of digital stream-hours has led to significant economic losses.

Line operators have been given recommendations for the proper FOCL operation and ensuring a normalized value of the line readiness coefficient. To this end, it is necessary to reduce the time to re-link and prolong the line’s failure-free operation.

**Keywords:** method of indicators control, quality and reliability of fiber optic communication lines.

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Розглядається актуальна задача гарантованого забезпечення якісною сировиною лісопереробного підприємства, що не має власних сировинних джерел. Запропоновано метод формування стійких ланцюгів поставок сировини на лісопереробне підприємство з урахуванням невизначеності та ризиків, пов'язаних із закупівлею сировини на товарно-сировинній біржі та реалізацією схеми доставки до складу. Розроблено динамічну модель, що представляє собою задачу стохастичного нелінійного програмування, цільовою функцією якої є витрати на призбання сировини. Модель дозволяє на заданому горизонти планування формувати план закупівлі сировини на лісові секції біржі з урахуванням невизначеностей за кількістю добових пропозицій, їх обсягами та цінами. Також враховується ризик відмови від укладеного договору в зв'язку з втратою якості сировини під час доставки та невиконанням термінів доставки. Для знаходження рішення моделі запропонована двоетапна схема, в якій на першому етапі знаходиться близький до оптимального «базовий» план закупівель. На другому етапі для розіграної для кожного дня реалізації випадкового потоку заявок вибирається такий план, який найбільш близький за обсягом закупованої сировини до «базової» та мінімізує сумарні витрати. Чисельне рішення на першому етапі знаходиться евристичним алгоритмом, який на окремих кроках використовує метод гілок і меж, і генетичний алгоритм. На другому етапі чисельно вирішується мултікритеріальне завдання математичного програмування. Розглянуто приклад формування лісопереробним підприємством Далекого Сходу субоптимального плану закупівлі сировини, що забезпечує підвищення ефективності та стійкості господарської діяльності в довгостроковому періоді.

Ключові слова: ланцюжки поставок, лісопромислова галузь, оптимізація планування закупівлі сировини, стохастичне нелінійне програмування.
Досліджено можливі відхилення значень необхідного (оптимального) на рейс диференту від фактичного, розрахованого після розподілу запасів і партий вантажів на прикладі серії розроблених вантажних планів. Слід зазначити, що значення диференту необхідного (оптимального) і фактичного для кожного окремого вантажного плану невіділяються більш, ніж на 8 %.

Отримані результати, наведені у статті, дають підстави стверджувати про доцільність їх використання при розробці вантажних планів суден трамвового судноплавства. Впровадження методики дозволить ефективно виконувати завантаження судна з повним використанням як його вантажопідйомністі, так і вантажомісткості. Використання запропонованої схеми розробки вантажного плану при перевезенні різноманітних вантажів скоротить загальний час розрахунку остійності і міцності судна в цілому.

Ключові слова: вантажний план, диферент, генеральний вантаж, диферентуючий момент, остійність судна.

**DOI:** 10.15587/1729-4061.2021.242478

**Розробка методики розрахунку індексу технічного стану вузлів локомотива на основі результатів моніторингу** (c. 37–45)

Б. Є. Боднар, О. Б. Очкасов, М. О. Очкасов

Широке впровадження інформаційних технологій в системи управління парками технічних засобів, використання систем технічного обслуговування і ремонту з урахуванням ризиків базуються на розрахунках значної кількості показників. Сучасні локомотиви оснащені системами моніторингу і діагностування технічного стану. Об'єднання цих систем з технологіями Інтернету речей і технологіями великих даних надає можливість використання абсолютно нових підходів до управління парком локомотивів. На початковому етапі побудови подібних систем необхідно розробити критерії, які дозволять в автоматичному режимі визначати технічний стан локомотива і його вузлів з метою відділити із загального парку локомотив, що потребує проведення технічного обслуговування чи ремонту.

Запропоновано методику розрахунку індексу технічного стану локомотивів і його вузлів на підставі даних систем моніторингу. Методика заснована на формуванні латентних діагностичних параметрів з використанням методу головних компонент і подальшому розрахунку вагових коефіцієнтів цих параметрів з використанням методу аналізу ієрархії. Відмінність запропонованої методики є в тому, що при розрахунку індексу використовуються латентні діагностичні параметри, які є похідними від групи контрольних параметрів, та вагові коефіцієнти розраховуються за допомогою методу аналізу ієрархії без необхідності залучення експертів.

Наведено результати розрахунку інформативності діагностичних параметрів навантаження, втрати, вхід та їх вагових коефіцієнтів. Найбільшу інформативність від 0,5 до 0,85 має параметр навантаження, найменшу (0,05–0,26) параметр вхід. Визначено середнє значення і залежності зміни індексу технічного стану гідравлічної передачі локомотива при випробуваннях. Аналіз індексу і діагностичних параметрів дозволяє оцінити реакцію гідравлічної передачі на зміну режимів її випробування, динаміку зміни втрат і інші параметри.

Ключові слова: індекс технічного стану, інформативність, діагностичні параметри, головні компоненти, гідравлічна передача.

**DOI:** 10.15587/1729-4061.2021.242744

**Розробка комплексного методу оцінювання ефективності проектів в умовах Scrum галузі інформаційних технологій** (c. 46–53)

Т. О. Прокопенко, О. В. Лавданська, Я. О. Поволоцький, Б. П. Ободовський, Я. В. Тарасенко

Запропонована комплексний метод, оцінюваний ефективності проектів в галузі інформаційних технологій, що забезпечить вирішення ефективних управлінських рішень. При цьому враховуються всі особливості реалізації методології Scrum, що включає у вирішення проблемами і меджерову оперативну прийняття управлінських рішень, що сприяє підвищенню ефективності проекту. Комплексний метод оцінювання ефективності проектів розроблений в класі організаційно-технічних систем на основі комбінованого заснування формалізованих, інтелектуальних та експертних методів. Результатом застосування даного методу є підвищення ефективності проекту на 1,52 % за рахунок зменшення часових обмежень, підвищення продуктивності команди.

Розроблено модель ефективності проекту, що забезпечить врахування особливостей організаційної та технологічної складової проекту, а також встановити логічні зв’язки між критичними, які характеризують з одного боку організаційну складову проекту, а з іншого проектно-технологічну. Отриманий індекс ефективності проекту сприяє подальшому дослідженню різних альтернативних сценаріїв реалізації проекту та прогнозу динаміки досягнення стратегічних цілей, а також динаміки реалізації процесів.

Запропонована процедура оцінювання ефективності проекту в умовах Scrum може бути використана в основу інформаційної технології управління проектом та відповідної системи підтримки прийняття рішень.

Ключові слова: комплексний метод, оцінювання, індекс ефективності, організаційна та технологічна складові.

**DOI:** 10.15587/1729-4061.2021.239854

**Розробка методу оцінювання стану об’єкту в інтелектуальних системах підтримки прийняття рішень** (c. 54–64)

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Проведено розробку методу оцінювання стану об’єкту в інтелектуальних системах підтримки прийняття рішень (СППР). Сутність методу полягає в забезпеченні високої якості аналізу поточного стану об’єкту, що досліджується. Ключовою відмінністю розроблено-
до методу є використання удосконаленого генетичного алгоритму. Удосконаленй генетичний алгоритм використовується на етапі побудови нечіткої когнітивної моделі. Використання удосконаленого генетичного алгоритму дозволяє підвищити оперативність ідентифікації факторів і встановлення зв’язків між ними за рахунок одночасного пошуку рішення декількома особами. Об’єктивний та повний аналіз досягається використанням уніфікованих нечітких темпоральних моделей стану об’єкту, врахуванням типу невизначеності та запущеності вихідних даних. Метод також містить удосконалену процедуру обробки вихідних даних в умовах априорної невизначеності, удосконалено процедур навчання штучних нейронних мереж та удосконаленої процедури топологічного аналізу структури нечітких когнітивних моделей. Сутність процедури навчання полягає в тому, що відбувається навчання синаптичних ваг штучної нейронної мережі, та характеристик функції належності, а також архітектури окремих елементів в архітектури штучної не- 115
Важливим для практики є можливість прогнозування наслідків процесів конфліктної природи за ознаками результативності і живучості її учасників.

Ключові слова: метод прогнозування, способи маневрування, евакуація, показники живучості, конфліктна ситуація.

DOI: 10.15587/1729-4061.2021.243298

РОЗРОБКА СИСТЕМИ ВИБОРУ ПРИДАТНОГО МІСЦЯ ПОСАДКИ ВСЕРЕДІНІ МІСЦЕВОЇ НЕБЕЗПЕЧНОЇ ЗОНИ (с. 84–91)

Pavol Kurdel, David Pastir, Jaroslav Zaremba, Lukas Korba, А. В. Яковлєва

У зоні успішної посадки та наведення літака на маршрут безпека польоту сприймається як найвищий ступінь дотримання всіх оперативно-керуючих функцій літака. Дані функції літака спостерігаються та ідентифікуються системами та когнітивними сприйняттями пілота. Ситуаційне керування літаком на маршруті з виявленим небезпеки, до якої може потрапити пілот, сприймається як точний елемент відмови. Якщо пілот потрапляє до такої ситуації, наприклад відмова йому пропонує інформаційна система літака. Характер та аварійне рішення у вищій критиці відмови систем літака - це керована посадка в локальному коридорі безпеки під час ведення літака за вибраним маршрутом. Метою роботи є теорія рішення для впровадження допоміжного елемента в малу авіацію з описом рішення автономного вибору геолокації у заданому локальному середовищі. Шляхом евристичного експерименту у статті обґрунтовуються методики вибору географічних зон для посадки літака з можливістю впровадження інформаційної системи літака. У статті представлена методика створення автономної системи допомоги, яка працює в напрямі зони посадки для посадки зі збором даних із ГІС-системи. Ця система може легко допомогти в навчанні пілотів і реальних польотах на невеликих літаках. Показано та доведено ефективність таких системи та параметризації даних. Розроблені моделі можуть бути використані для створення автономних систем вибору для аварійних відмови летальних апаратів.

Ключові слова: аварійна ситуація, відповідна геолокація, система допомоги, район польоту, критерії ефективності.

DOI: 10.15587/1729-4061.2021.237583

РОЗРОБКА МЕТОДУ КОНТРОЛЮ ЯКОСТІ ТА НАДІЙНОСТІ РОБОТИ ВОЛОКНО-ОПТИЧНИХ ЛІНІЙ ЗВ’ЯЗКУ (с. 92–100)

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Відсутність у нормативно-технічній документації з експлуатації волоконно-оптичних ліній зв’язку (ВОЛЗ) рекомендацій з оцінювання технічного стану викликало необхідність розробки методу контролю якості та надійності роботи ВОЛЗ. Метод створює основи для розрахунку показників якості та надійності роботи ВОЛЗ. Він визначає способи контролю збірку і аналізу статистичних даних пошкоджень з перервою та без переривання зв’язку.

Із приведеної графічної послідовності реалізації етапів методу показано, що до вирішення задач контролю цих показників слід віднести:
– організацію збору та збір експлуатаційних даних пошкоджень (причин, характеру, кількості, тривалості перерв зв’язку та повного усунення пошкодження);
– щорічне визначення показників якості та надійності роботи ВОЛЗ;
– аналіз отриманих результатів та розробку (корекцію) заходів дотримання норм цих показників;
– реалізацію заходів дотримання норм показників якості та надійності роботи ВОЛЗ (за необхідністю).

На основі експлуатаційних даних оператора лінії, отриманих за три роки в заданій кліматичній зоні (кабель типу ОКЛБг-3 ДА12-3×4Е-0,4Ф3,5/0,22Н18-12/0) проведено дослідження методичної складової методу.

Отримані результати показників якості (щільність пошкоджень, середня тривалість пошкоджень, перерва (простій) зв’язку) та надійності роботи (коефіцієнт готовності ВОЛЗ) є базою для розробки нормативно-технічної документації і оптимізації параметрів зв’язку.

Ключові слова: метод контролю показників якості та надійності волоконно-оптичних ліній зв’язку.