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6. Rogovskii I. L. Analysis of grain losses by the classic threshing-separating device of the combine harvester. Scientific reports of NULES of Ukraine: electronic edition. Kyiv. 2021. № 4(92) (2021). https://doi.org/10.31548/dopovidi2021.04.012 file:///C:/Users/Ivan/Downloads/ 15140-35724-1-PB.pdf.

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GROUP COMMUNICATIONS OF THE SYSTEM FOR RESTORATION OF WORKING CAPACITY OF GRAIN HARVESTING COMBINERS

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During developmentcomplex system of restoring the operational efficiency of agricultural machines [1], there is a problem of justifying a strategy that would allow obtaining the maximum possible effect from the operation of machines [2].

Usually, when setting the task of prevention, given characteristics of the reliability of agricultural machines are assumed: the function of the time distribution of the system's fault-free operation $P(x)$ or its separate parts and the distribution function of the time of independent manifestation of failure $\Phi(v)$ and maintainability characteristics: time distribution functions of various restoration works that can be carried out in the system [3]. These characteristics, as well as the strategy [4], according to which the terms of restoration work are assigned, determine the state of the system and the evolution of these states over time [5].

Let's assume that there are many E possible states of the system is finite $E=\{E1,E2, ...,En\}$. In this case, the process trajectories $x(t)$, describing the evolution of system states over time, are step functions. On the trajectories of this random process, we will define a functional which, with fixed reliability characteristics, will characterize the service strategy of the studied system. For a finite period of time $[0,t]$ process trajectory $x(t)$ given by the number of transitions m, moments of transitions$t_0=0<t_1<t_2...<tm\leq t$ and Ei_0, Ei_1, ..., Eim, in which the process is between moments of transition. Then we define the functional as a mathematical expectation:

$$M\{\sum_{k=0}^{m-1} c_{ik}\cdot(t_{k+1}+t_k)+c_{im}\cdot(t-t_m)\}, \quad (1)$$

where are constants c_i can be interpreted as the income received per unit of time spent in the state Ei. With long-term use ($t\to\infty$) functional (1) tends to infinity. It is also necessary to consider the specific income, i.e.

$$I=\lim_{t\to\infty}\frac{1}{t}M\{\sum_{k=0}^{m-1} c_{ik}\cdot(t_{k+1}+t_k)+c_{im}\cdot(t-t_m)\}, \quad (2)$$

Functional for the regenerating process$I$can be defined as

$$I=\sum_{i=1}^{n} c_i\cdot k_i=\sum_{i=1}^{n} c_{ik}\cdot\frac{M_i}{M}=\frac{\sum_{i=1}^{n} c_i\cdot M_i}{M}, \quad (3)$$

where k_i is the average time ratio Mi, held in the state Ei during the regeneration period, until the middle of the duration of this period M.

Process behavior $x(t)$ depends on the distribution function of the system uptime $P(t)$. Time sharing functionξindependent manifestation of refusal $\Phi(x)$ and characteristics that determine the timing of regenerating factors (precautionary prophylaxis is scheduled after a random time η, distributed by law $G(x)$). Therefore, average durations also depend on these functions M and $Mi()$. $i = \underset{1,n}{\longrightarrow}$We consider, that the regeneration period begins at the moment of complete system renewal and at the same timemomentanother prophylaxis is prescribed. The studied functional (3) can be written as a fractionallinearfunctional of the species

$$I = I(G, \Phi, \mathrm{P}) = \frac{\mathrm{A}(\mathrm{x,v,y})dG(x)d\Phi(\mathrm{v})dP(y)}{\mathrm{B}(\mathrm{x,v,y})dG(x)d\Phi(\mathrm{v})dP(y)}. \quad (3)$$

If the process $x(t)$, which describes the evolution of system states over time, takes a finite set of values and is regenerative, then the functional that characterizes the quality of system operation has the form of a fractional-linear functional (4) with respect to the time distribution function of fault-free operation $P(t)$, distribution functions of the time of independent manifestation of failure $\Phi(x)$ and distribution functions $G(x)$, which determines the periodicity of preventive preventive measures.

In expression (4) is a function $A(x,v,y)$ and $B(x,v,y)$ have the meaning of conditional mathematical expectations, provided that the event $\{\xi=y,\eta=x,\zeta=v\}$. Strategyrestoring the efficiency of agricultural machinesshould be laid at the level of formation of the management system. An important problem is also the division of functions between the project and organizational subsystems, which is why some of the management functions (for example, determining the implementation terms, resource allocation) remain the prerogative of the center, which is not always effective. This type of structure is advisable to use in largesystems for restoring the efficiency of agricultural machines, whose implementation conditions are not fully defined. Thus, in its pure form, none of the existing structures is ideal.

Let the total amount of work be determineda complex system of restoring the efficiency of agricultural machines, on the basis of which we develop a work schedule. In general, such a schedule can be presented in the form of a system consisting of objects of three types.

We will use the graph-theoretic description of the system: Σ =(Q, U, ε), where Q is a setpeaks, U is the set of edges, ε is the incidence ratio that assigns y to each edge of Uconformitya pair of vertices from Q:

$$u \in U \Longrightarrow (\exists! \ \langle p,q \rangle \ \in Q\mathrm{x}Q)(u\varepsilon \ \langle p,q \rangle \ ). \quad (5)$$

Functionsdescribe the behavior of system elements and are represented by a set of sets: F = 〈R, f〉 , where R = (Ai) i∈I is a family of some basic sets Ai (signals, trajectories, resources, i.eplurals, on which the functions are defined), f is the set of all representations

$$\prod_{i\in I_1} A_i \rightarrow \prod_{i\in I_2} A_i, \ ,I_1 I_2 \subset I \quad (6)$$

that is, functions that reproduce certain implementation tasksof a complex system of restoration of operational efficiency of agricultural machines. This is due to the consumption of resources. In this case, it is necessary to take into account the connections caused by the presence of type restrictions

$$\varphi_k[f_k(\prod_{i\in I} A_i,)] \leq u_k. \quad (7)$$

where u_k is the limit of resources allocated for the implementation of the k-th function,φ_k – consumption of resources for the implementation of the fk function.

Thus, the work schedule is a structure, the vertices of which are matched to functions, and the edges are the basis sets on which these sets are defined. Each vertex is characterized by the amount of resources consumed, the time it takes to perform its functions, and each edge can be characterized, for example, by bandwidth. To build an effective control system, it is necessary to optimize the distribution of functions f on the nodes of the system Q. One of the following functionals can be taken as the target function of the model of the distribution of functions on nodes: minimization of the total cost of tasks; minimization of the total time of tasks; minimizing the maximum time for solving tasks. Depending on the features of managementa complex system of restoring the efficiency of agricultural machines, an integer optimization model for the distribution of individual tasksof a complex system of restoration of operational efficiency of agricultural machinesby nodes is composed of the given target functions and constraints. To form a strategyrestoring the efficiency of agricultural machinesand building an effective management structurea complex system of restoring the efficiency of agricultural machinesit is necessary to separate into groups the elements most strongly connected with each other and at the same time weakly connected with other elements. Such groups are called sets of works.

Conclusion. The considered model is an optimization problem and allows combining structural elementsof a complex system of restoration of operational efficiency of agricultural machinesin groups that are optimal from the point of view of minimizing intergroup connections. As a result, the two lower levels of the hierarchy are combinedof a complex system of restoration of operational efficiency of agricultural machines, each of which is headed by a system that controls the functioning of the complex.

References

1. Rogovskii I. L. Analyticality of complex criteria for estimating grain production in agricultural enterprises by intensification of engineering management. Machinery & Energetics. Journal of Rural Production Research. Kyiv. Ukraine. 2021. Vol. 12. No 4. P. 129-138. http://dx.doi.org/10.31548/machenergy2021.04.129.

2. Nazarenko I., Mishchuk Y., Mishchuk D., Ruchynskyi M., Rogovskii I., Mikhailova L., Titova L., Berezovyi M., Shatrov R. Determiantion of energy characteristics of material destruction in the crushing chamber of the vibration crusher. Eastern-European Journal of Enterprise Technologies. 2021. Vol. 4(7(112)). P. 41-49. https://doi.org/10.15587/1729-4061.2021.239292.

3. Rogovskii I., Titova L., Sivak I., Berezova L., Vyhovskyi A. Technological effectiveness of tillage unit with working bodies of parquet type in technologies of cultivation of grain crops. Engineering for Rural Development. 2022. Vol. 21. P. 884-890. https://doi.org/10.22616/ERDev.2022.21.TF279.

4. Rogovskii I., Titova L., Novitskii A., Rebenko V. Research of vibroacoustic diagnostics of fuel system of engines of combine harvesters. Engineering for Rural Development. 2019. Vol. 18. P. 291-298. doi.org/10.22616/ERDev2019.18. N451.

5. Rogovskii I. L. Models of formation of engineering management alternatives in methods of increasing grain production in agricultural enterprises. Machinery & Energetics. Journal of Rural Production Research. Kyiv. Ukraine. 2021. Vol. 12. No 1. P. 137-146. http://dx.doi.org/10.31548/machenergy2021.01.137.

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СТРУКТУРНІСТЬ МАШИНОВИКОРИСТАННЯ ТЕХНОЛОГІЇ STRIP-TILL

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Агро-кліматичні умови є основою що створює портрет сільського господарства того чи іншого регіону і має значний вплив на локальний вибір технологій землеробства [1]. В цілому за попереднє століття клімат не зазнав таких значних змін як за останні десятиліття, а деякі технології обробки ґрунту стали традиційними [2]. Але тенденції зміни клімату і технологій у двадцять першому столітті кидають виклик аграріям не тільки в Україні, а й у світі в цілому [3]. Кліматичні зони України зміщуються на північ та захід, спека і посухи стають все більш катастрофічними і ті технології, які ще вчора були ефективними сьогодні не забезпечують повної віддачі [4].

Значна частка посівних площ України знаходиться в зоні ризикованого землеробства, відповідно ризик втрати урожаю, в посушливий рік, є постійним супутником Українського землероба, а фактор глобальної зміни клімату посилює такі ризики [5]. Останні десятиліття клімат демонструє тенденцію до загального потепління, яке охоплює всю територію нашої країни, а рівень підвищення температури повітря навіть дещо випереджає середньосвітовий. Основний параметр зміни клімату це зміна середньої річної температури повітря на висоті 1 метр над поверхнею землі.

За останні 30 років середня річна температура повітря в Україні підвищилася більше, ніж на 1 °С. Відхилення температури повітря від норми по всій території України у період 1989-2019 рр. була найбільшою за всю історію інструментальних спостережень за погодою. Середньо-річна кількість опадів за