Rabotosposobnost,machine,stochasticity.

In paper the methodigical approach to description of stochastic ensure efficiency of agricultural machinery.
Efficiency, machine, stochastics.

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ANALYSIS FREQUENCY OF MAINTENANCE FORESTRY MACHINES TO WORK

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The article presents the results of methodical positions on a mathematical model describing the frequency of software maintenance machines for Forestry work.
Means, maintenance, frequency machine.

Formulation of the problem. On the length of stay of machines for Forestry work (further - cars) in non-working condition and the cost of maintenance and repair affects adopted a system to ensure their operational and resource exchange elements and materials, which includes the range, quantity, placement in storage, frequency and order replenishment latter.

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Analysis of recent research. In [1] developed a method to determine the optimal frequency of maintenance of machines for the criterion of minimum total unit costs:

$$C\left(t_i^{TO}\right) = C_O\left(t_i^{TO}\right) + C_{ПР}\left(t_i^{TO}\right) \rightarrow \min, \qquad (1)$$

where: $C_O\left(t_i^{TO}\right)$ - Specific maintenance costs and eliminate failures; $C_{ПР}\left(t_i^{TO}\right)$ - Specific losses from idle cars.

The optimal frequency of maintenance is determined according to calculations made for different values of frequency, but it is related only to the costs and ignores the actual changes in the technical condition of vehicles.

The optimal frequency of maintenance and repair of vehicles, according to the method [2] determined the conditions of their largest productivity. The volume of work done for that calendar period, thus, is defined as:

$$V = Q_T t_p = Q_T t_к К_Т К_Г \left(К_{ОРГ} + К_{ОБС} - 1\right), \qquad (2)$$

where: QT - the technical performance of the machine; CT - factor process losses, CT = tp / (tp + TT); KG - readiness factor, CG = (tp + TT) / (tp + TT + TV); Corgi - rate losses due to organizational reasons Corgi = (n Mean TC-torh) / n Mean TC; KOBS - Stretched, KOBS = (n Mean TC-tobs) / n Mean TC; tp, n Mean TC, TT, TV, torh, tobs - respectively a productive work time without loss time idling or moving the machine, the restoration (elimination of failures) downtime due to organizational reasons and unfavorable weather conditions, maintenance time .

In work [3] grounded frequency of maintenance productivity machine that decreases according to a decrease in engine power due to wear, rozrehulyuvan and aging. A dependence of the average effective engine power Necp the frequency of maintenance is a type of x [3]:

$$N_{еср} = N_{ен} - \frac{\Delta N_e}{2} = N_{ен} - \frac{x}{2} tg\alpha , \qquad (3)$$

where: Ne n - effective rated power; α - Angle straight Ne = f (x) for the horizontal axis.

After maintenance engine power restored, but in the subsequent operation of the machine is reduced again[4]. Increasing the average power reduction by x increases operating time or seasonal Wsez machine performance and reduce the use of time τ by increasing spending time on maintenance [τ_x= *f*(X)] reduces seasonal performance machine Wsez.

But significant disadvantage of these methods is that as the optimality criterion and output dependencies accepted average values of excluding their probabilistic nature, which is in reality [5].

These methods do not allow to build flexible maintenance cycles with different types of group prevention and effective only for large-scale forecasting and planning needs for repair actions when installed system maintenance and repair[6].

The purpose of research. To substantiate methodological provisions describe the mathematical model ensuring periodicity of maintenance machines for Forestry work.

Results. The method, the essence of which is to determine the optimal frequency of maintenance of the necessary conditions to ensure technical readiness of the machine and, simultaneously, the greatest probability of failure-free operation.

Taking into account that the time between service T'p = m (T + TV)

/ mn to, time between failures T = aKb, availability factor KG = T / (T + Te) = 1 / (1 + B), the expression :

$$P_{e.в} = \frac{1}{1/K_Г + K_{TO} m_n / m} \exp - \left({mK_b}\Big/{m_n K_Г} \right)^b . \qquad (4)$$

Investigating the expression (4) to the extreme, the expressions for calculating the optimal frequency of maintenance for the billing period and optimal operation time between maintenance:

$$m_{n\ opt} = m \frac{K_b}{K_Г} \sqrt{b/(b+1)}, \qquad T_{n\ opt} = \frac{T}{K_b \sqrt[b]{b/(b+1)}} .$$

In terms of the control of the state, reliability of machines described methodical approach is passive, as the rule specifies only stop operation, but does not affect the formation of operational reliability to a halt. Therefore, the technical condition of the machine during operation varies under the influence of the following factors:

- The effect of factors that degrade the technical condition, can be represented by the function y = φ (S, Z, D, M), where S - aging; Z - wear; *D* - Deformation; M - strength;

- The effect of factors that reduced technical condition, can be represented by the function z = φ (V, K, O, Y), where V - the cost of service;

K - Monitoring and verification; O - maintenance; Y - recovery and troubleshooting.

Therefore, it is proposed to use when optimizing maintenance frequency dependence of the technical condition s during t:

$$\frac{dx}{dt} = Q(x, y, z, t) .$$

Changing the technical condition of the car under the influence of operational factors determined by a combination of occurrence of sudden and gradual failures. To characterize the impact of their use of the function of the probability of failure:

$$F(t) = 1 - [1 - F_1(t)][1 - F_2(t)],$$

where: F1 (t) and F2 (t) - probability at gradual and sudden failure.

Based on the statistics of failures can set the pattern changes the probability of failure of this type of machines, such as in Fig. 1.

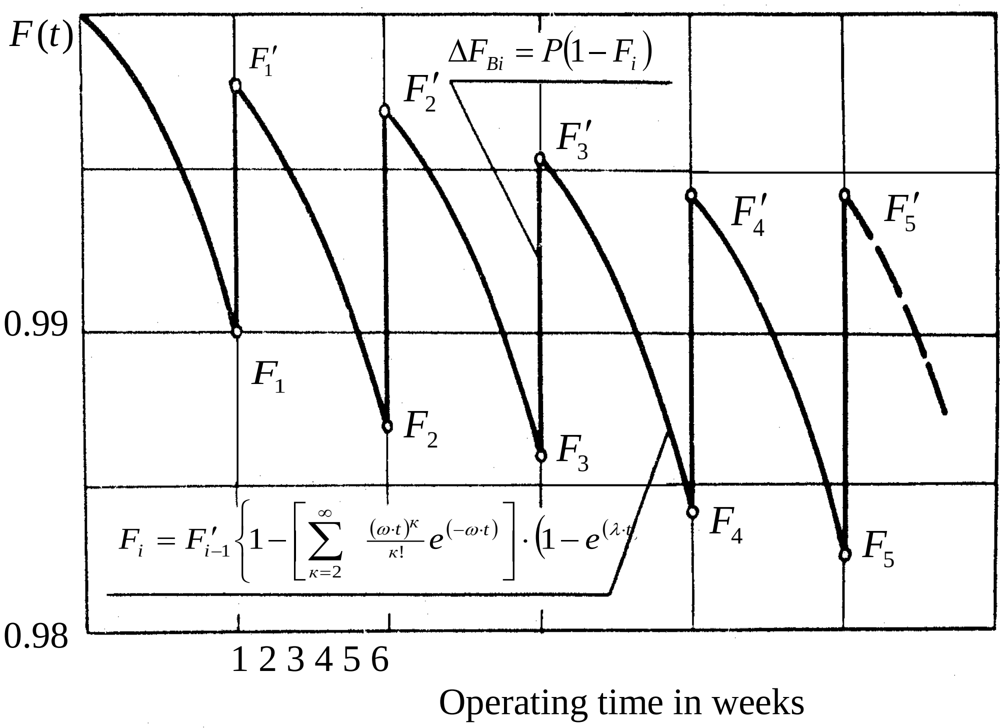


Fig. 1. Model changes in the technical condition of vehicles.

Calculating the actual recovery of technical condition before service displays operating conditions:

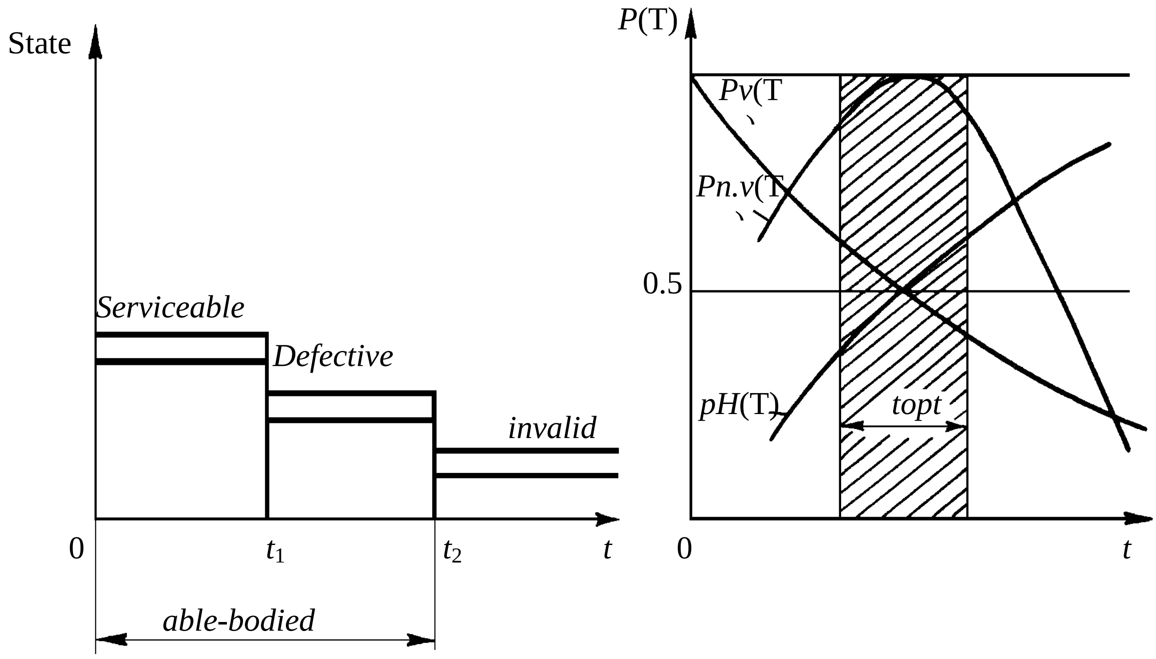
$$\Delta F_{Bi} = (1 - F_i) \cdot P,$$

where: Fi - technical condition before the next service on the basis of the previous maintenance:

$$F_i = F'_{i-1}\left\{1 - \left[\sum_{\kappa=2}^{\infty} \frac{(\omega \cdot t)^{\kappa}}{\kappa!} e^{-\omega \cdot t}\right]\left(1 - e^{-\lambda \cdot t}\right)\right\},$$

Where: F'i-1 - technical state at the beginning of the period; expression in braces is a function of changes in the technical condition for turnaround time; P - probability of finding and troubleshooting when served.

When optimizing the frequency of maintenance in terms of patterns of refusals find the maximum probability of joint events: malfunction PH (t) and the refusal of disclosure Rn.v (t). At the same time believe that troubleshooting in a timely prevented the occurrence of failures. As shown in Fig. 2, and since the beginning of operation t0 = 0 begins to develop a fault that appears at random time t1. From this moment begins the second stage of denial that continues to random time t2. Disclaimer element arises at a time TV = t1 + t2.



and) b)

Fig. 2. Scheme of process failure (a) and a graph of the probability parameters of time (b).

Between the time of occurrence of failure and rejection probability exists or functional relationship. Item joint probability event and not a malfunction of failure is expressed as the product of two components:

- the possibility that after time *t* for the maintenance tTO in the unit will not have denial;
- probability of failure for a small period of time before carrying out maintenance, ie:

$$dP_{н.в}(t) = [1 - P_2(t_{TO} - t)]P_1(t)dt. \quad (5)$$

Adding up this expression in the range of zero to tTO and if a malfunction t1 and t2 failures has exponential distribution law, the probability of the joint event takes the form:

$$P_{н.в}(t) = \int_0^{t_{TO}} \exp[-\lambda_2(t_{TO} - t)]\lambda_1 \exp(-\lambda_1 t)dt, \quad (6)$$

nature of the change which is shown in the graph (Fig. 2b).

The method for determining the frequency of technical maintenance for efficient machine components that require control and inspection, regulatory interventions.

Conclusion. The problem is devoted to calculating the optimal frequency of preventive measures vinovlennya efficiency machines Forestry works at a single regulated by operating time strategy. Calculations were carried out with limited function failure rate and probability of failure-free operation.

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In Article predstavlenы results about A methodical descriptions matematycheskoy model provisions Provision of technical peryodychnosty of service machines lesotehnycheskyh works.

Assets, Tehnicheskoe Maintenance, peryodychnost machine.

Results of rather methodical provisions of description of mathematical model of ensuring frequency of maintenance of machinery for timber works are presented in paper.

Means, maintenance, frequency, mashine.

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METHOD FOR DETERMINING PARAMETERS OF INERTIA OF CROP PLANTS

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In the article the method of determining the parameters of inertia of plant crops by sharing their linear density. The analytical and