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PROBLEM OF CRITERION ANALYSIS OF PLAY-TECHNOLOGICAL SYSTEMS OF PACKAGING LINES

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Abstract: *The priority tasks of the scientific and technical nature, which creates conditions improvement of process operation of packing equipment include: the introduction of modern hardware, software and algorithmic providing parametric control and diagnostic equipment, tools and methods of control of technological parameters in real time conditions. The results of the offer the opportunity to track the effectiveness of a particular machine in a line or functional module by OEE. And upgrades, or replacement of the most challenging management system for improvement of equipment. Conclusions. Obtained as a result of processing the values of parameters of reliability during operation, as a rule, are compared with the corresponding values of the indicators for previous periods. This approach allows to carry out a quality assessment of the level of reliability in relation to previous periods.*
Key words: *diagnostic criteria, synthesis, packaging equipment.*

INTRODUCTION

Among the important tasks in improving the operation of packing equipment for the technical condition is to improve the system of collection, processing and analysis of information about the technical condition and reliability of technical systems.Timely detection of points of origin of degradation processes that determine the timing of the transition in the limit State and is tailor-made for every type of functional modules of the technological line is to control the level of reliability engineering on the stage of its layout and operation. All larger gaining system solid state parametric modeling.

STATEMENT

Among the important tasks in improving the operation of packing equipment for the technical condition is to improve the system of collection, processing and analysis of information about the technical condition and reliability of technical systems. All larger gaining system solid state parametric modeling. A common disadvantage of software simulations is that they are given for the use of common methods of single and Multicriteria optimization, each of which has its own limitation on the use, accuracy and speed of getting results. This prevents a comprehensive, unified position, to assess the quality of the future equipment in various stages of design, optimize its structure and settings at the same time. The structure of the play is the technological line (PTL) can be presented on the basis of two phases of assessment: the structural and parametric synthesis (Figure 1). The concept of "optimal solution" is the best in the given sense of the solution of the problem that allowed conditions. To assess the reliability of the play – the technological systems of packaging lines used by established standards of performance, given in table 1. From table 1 we see that their reliability (for example, maintainability) characterize only one of the properties of a technical object line, while comprehensive indicators characterize several properties, and in the future will be used as the key to assess the effectiveness of such complex objects like line and its functional modules. These indicators include the coefficient, the coefficient of operational readiness and maintenance coefficient use coefficient of preserving the efficiency [1]. Coefficient of readiness

$K_Г(t)$ taken to determine how probable that the object will be in working condition at any point in time, in addition to the scheduled periods, during which the application object for other purposes not envisaged [2,3]. Reliance $K_Г(t)$ from time to time is often referred to as the transient coefficient of readiness(the function of readiness). Obtain an expression for the unsteady coefficient of readiness the analytic form is quite difficult and generally he has the form [2,4]:

$$K_Г(t) = P(t) + \int_0^t P(t-\tau)\omega_B(\tau)dt,$$ where $\omega_в(\tau)$ – option stream restorations. (1)

Along with this, for any distribution of an operating time between failures and recovery time can prove that a stationary coefficient of readiness is:

$$K_Г = \frac{M(T_0)}{M(T_0) + M(T_в)}, \quad (2)$$

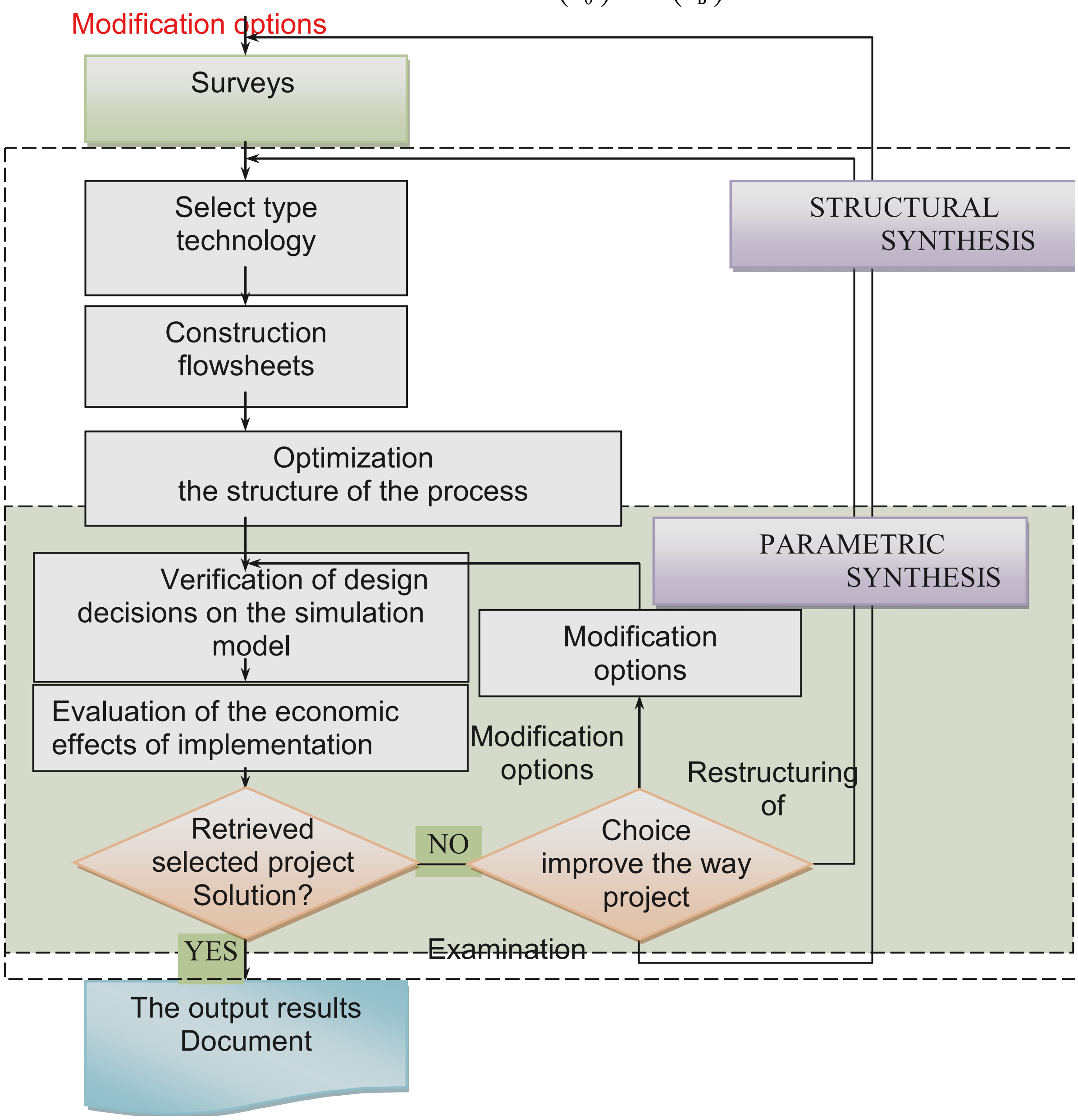


Fig. 1. Block diagram of the process of computer-aided design

Where $M\left(T_0\right)$ – expectation of time finding PTL in employers capable state; $M\left(T_{\text{в}}\right)$ – expectation cooldown PTL. Along with $K_{\text{г}}\left(t\right)$ injected coefficient of operational $K_{\text{г}}\left(t, t+\tau\right)$ as probable that the object will be in working condition in a random amount of time, in addition to the scheduled periods, during which the application object for other purposes not envisaged, and from this point will work flawlessly during the set time interval τ:

$$K_{\Gamma}\left(t,t+\tau\right)=P(t+\tau)+\int_{0}^{t}P(t+\tau-x)\omega_{B}(x)dt, \tag{3}$$

The main indicators of reliability Table 1

Property	Indicator	Marking
	The main indicators of reliability	
Infallibility	Reliabilities	$P(t)$
	Failure	$\lambda(t)$
	Failure flow parameter	$z(t)$
	Mean time to failure	T_1
	Mean time between failures	T_0
Durability	Average yield	T_n
	Operating resource (average lifetime)	T_e
	Gamma-percent life time	$T_{\gamma e\%}$
Maintainability	The probability of recovery	$P_{\text{в}}$
	Iintensity recovery	$\mu(t)$
	The average duration of recovery	$T_{\text{в}}$
Preservation	Medium term zberezhuvanosti	T_3
Preservation	Gamma-term interest zberezhuvanosti	$T_{\gamma 3\%}$
	Complex	
Faultlessness and maintainability	The availability index	$K_{\text{г}}$
	Coefficient of operational readiness	$K_{\text{ог}}$
	Coefficient technical use	$K_{\text{ТВ}}$

For the study of the impact of implemented methods and modes of maintenance and repair of the efficiency of the process of technical operation used another comprehensive reliability – the coefficient of the technical use $K_{\text{ТВ}}$, which is equal to relation of mathematical expectations (ME) time of an entity in working condition for a period of operation $M\left(T_0\right)$to sum ME time entity is in working condition and the total time of downtime on all types of maintenance and repair work:

$$K_{\text{ТВ}}=\frac{M\left(T_0\right)}{M\left(T_0\right)+M\left(T_{\text{пр}}\right)}, \tag{4}$$

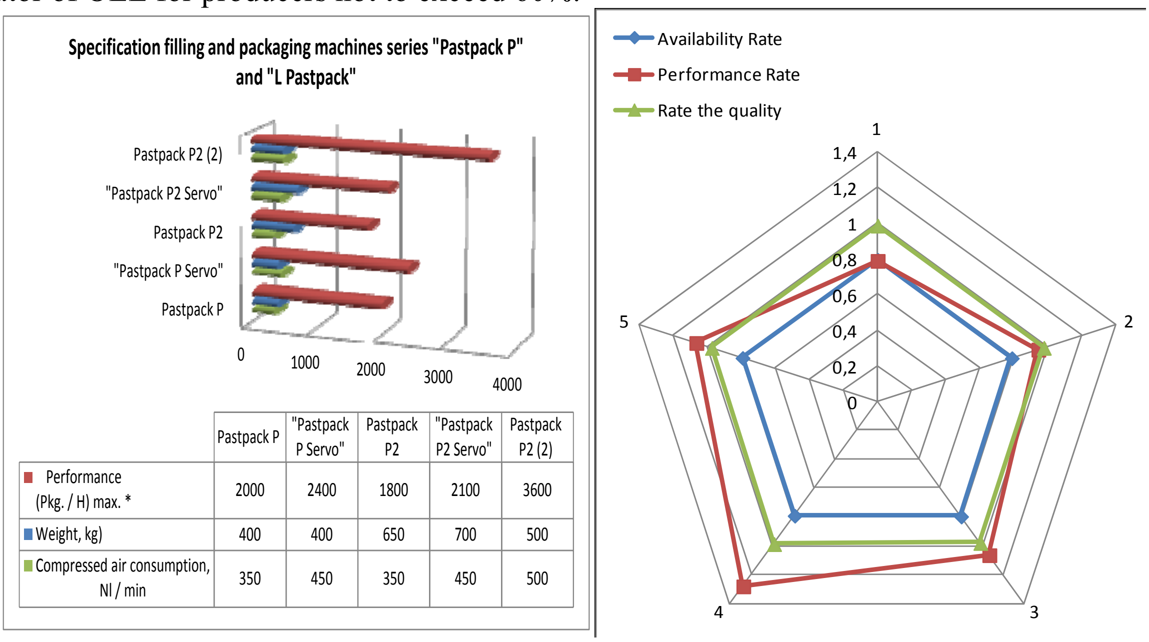
Where $M\left(T_{\text{пр}}\right)$ amount of mathematical expectations of downtime on the periodical, routine, seasonal work, during work, repairs, troubleshooting, etc. Consider the approach which criterion of OEE (Overall Equipment Effectiveness) is best suited for packing equipment-approach to the surveillance and management of material, information flows. It was introduced in the late sixties of the last century Japanese Nakajima (Seiichi Nakajima), but started to be used outside of Japan only in the late eighties.

$$\text{Availability Rate} = \frac{\text{Operating Time}}{\text{Total Available Time - Scheduled Downtime}}$$

$$\text{Performance Rate} = \frac{\text{(Total Production / Production Time)}}{\text{Ideal Run Rate}}$$

$$\text{Rate the quality} = \frac{\text{(Total Production - Total Scrap)}}{\text{Total Production}}$$

Easy to see that substituting the values of the factors in the formula 1 and taking shortcuts, you can get that figure equals the OEE regards the amount of high-quality products to the planned time times the perfect speed. Thus, it can also be defined as the ratio of the volume of high-quality products to the ideal amount that could be made if the equipment work during scheduled time at maximum (ideal). The fact that the observation of the value of the OEE is a kind of starting point. Discover the OAE is different from the target (for example, it fell in comparison with the previous period), you can see what impact this fall. Analyzing the value of each of the three factors and comparing them, for example, the values for previous periods, we gradually localize the cause of the loss of efficiency. If the problem lies in quality or reduce the speed of the equipment, then this is a signal for the relevant services. If the problem lies in the area of accessibility, it is possible to make a more in-depth analysis of the reasons that we consider a bit later, when we talk of control equipment. According to research [1] best world manufacturers reach the level of the production process with the OEE is above 85%. The value of basic indicators in the case of the achievement of the value given in table 2. These data are vital for continuous production. For discrete industries similar to OEE metric is equal to 80% [2]. Note that for many companies the value of quality score exceeds the specified in table 2. However, in accordance with the mentioned research the average indicator of OEE for producers not to exceed 60%.



	Pastpack P	"Pastpack P Servo"	Pastpack P2	"Pastpack P2 Servo"	Pastpack P2 (2)
Performance (Pkg. / H) max. *	2000	2400	1800	2100	3600
Weight, kg)	400	400	650	700	500
Compressed air consumption, Nl / min	350	450	350	450	500

Fig. 2. Diagram of the overall equipment effectiveness OEE

This fact points to a potential optimization of production in the field of performance and availability. We developed a spreadsheet instructions OEE calculator spreadsheet, which simplifies the task to calculate individual and combined figures of OEE to study PTS to ten machines. The example given below on Fig. 2, obtained by an open information for equipment: automatic thermo - forming a weighing-and-packing line the equipment "Tauras-Fenix" -full cycle of wrapping and packaging of any products (*Table 2*), starting with the blowing of plastic container or beaker polymer film, filling out their product (commodity) using the dispenser, coversealing material with printed label and the cutting sealed cups or containers filled with product (commodity) into separate containers.

Table 2

	Machine	Batch or Product	Scrap 1	Scrap 2	Total Production	Total Available Time	Scheduled Downtime	Unscheduled Downtime	Operating Time	Ideal Run Rate	Availability Rate	Performance Rate	Rate the quality	OEE
1	Pastpack P		1	3	2000	2000	20	78	1902	1,25	96,1%	84,1%	99,8%	80,6%
2	"Pastpack P Servo"		2	5	2400	3000	20	80	2900	1,1	97,3%	75,2%	99,7%	73,0%
3	Pastpack P2		3	4	1800	3500	20	78	3402	1	97,8%	52,9%	99,6%	51,5%
4	"Pastpack P2 Servo"		4	2	2100	3700	20	80	3600	1,1	97,8%	53,0%	99,7%	51,7%
5	Pastpack P2 (2)		5	3	3600	3800	20	78	3702	1	97,9%	97,2%	99,8%	95,0%

The results are shown in figure in spreadsheet format, developed by its own algorithm.The results of the offer the opportunity to track the effectiveness of a particular machine in a line or functional module by OEE. And upgrades, or replacement of the most challenging management PTAS for improvement of equipment.

CONCLUSIONS

Obtained as a result of processing the values of parameters of reliability during operation, as a rule, are compared with the corresponding values of the indicators for previous periods. This approach allows to carry out a quality assessment of the level of reliability in relation to previous periods. In this case, as stated above, do not take into account the impact on the statistical evaluation of the indicator of intensity of exploitation. Statistics of failure and faults are received in the unstable conditions of supervision, which greatly affects the accuracy and reliability of the evaluation. One of the specific objectives of the study is to improve the methodology of statistical reliability monitoring units ship equipment taking into account the impact of the intensity of operation and unstable conditions.

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