DECREASE IN RISK ERRONEOUS CLASSIFICATION THE MULTIVARIATE STATISTICAL DATA DESCRIBING THE TECHNICAL CONDITION OF THE EQUIPMENT OF POWER SUPPLY SYSTEMS

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ABSTRACT

Objective estimation of parameters of individual reliability is an indispensable condition of an opportunity of decrease in operational expenses for maintenance service and repair of the equipment and devices of electro power systems. The method of decrease in risk of erroneous classification of multivariate statistical data offered. The method based on imitating modeling and the theory of check of statistical hypotheses.

I. INSTRUCTION

Estimation parameters of individual reliability of the equipment of power supply systems provides classification of final population of multivariate statistical data of operation, tests and restoration of deterioration on the set versions of attributes (VA) [1].

VA reflects features of a design, a condition of operation, feature of occurrence of refusals and carrying out of repairs of the equipment. Expediency of classification on each of population VA is established by comparison of statistical functions of distribution (s.f.d.) final population of statistical data $F^*_\Sigma(X)$ and s.f.d. samples n random variables from this population on i versions of V attribute $F^*_{V,i}(X)$, where v=1, k; k-number of attributes of random variable X (for example, durations of emergency repair); i=1, rk; r_k- number of versions k an attribute. If s.f.d. $F^*_\Sigma(X)$ and $F^*_V(X)$ differ not casually, in other words, sample $\{X\}_n$ where n-number of random variables of sample, it is not representative classification of data at an estimation of parameters of individual reliability is expedient and on the contrary. It is necessary to note, that unlike sample of a general data population (analogue: infinite set of random variables with uniform distribution in an interval [0,1]), which imposing appearance is set by some significance value α, sample of final population of multivariate data on set VA is not casual, as a matter of fact, and it can appear only representative. In particular, sample can appear representative, if for considered data set VA not significant.

II. RECOMMEND METHOD

In a basis of comparison $F^*_\Sigma(X)$ and $F^*_V(X)$ there is a statistical modeling (by means of computer program RAND) n pseudo-random numbers ξ, random variables of sample equal to number, with uniform distribution in an interval [0,1].

Indispensable condition thus is consistency s.f.d. $F^*_V(\xi)$ to the uniform law of distribution $F_\Sigma(\xi)$, in other words, casual character of distinction $F_\Sigma(\xi)$ and $F^*_V(\xi)$. It is obvious, that from the uniform law of change of random numbers ξ at all consistency does not follow the uniform law s.f.d. $F_V^*(\xi)$ with the set significance value α. Use at modeling statistical analogue $F_V^*(X)$ s.f.d. $F_V^*(\xi)$, essentially differing from $F_\Sigma(\xi)$, leads to erroneous increase in value of the greatest divergence of distribution of this analogue $F_V^{**}(X)$ from $F_\Sigma^*(X)$ and by that to growth of probability of the erroneous decision at classification of data.

Representative character of sample $\{\xi\}_n$ at the decision of a problem of an estimation of expediency of classification of multivariate data it was supervised Kolmogorov's by criterion [2]. According to this criterion sample $\{\xi\}_n$ it is unpresentable, if

$$D_n > d_{n,(1-\alpha)} \tag{1}$$

where:

$$D_n = \max(D_n^+, D_n^-) \tag{2}$$

$$D_n^+ = \max\{D_i^+\}; \quad 1 \le i \le n \tag{3}$$

$$D_i^+ = \left(\frac{i}{n} - \xi_i\right) \tag{4}$$

$$D_n^- = \max\{D_i^-\}; \quad 1 \le i \le n \tag{5}$$

$$D_i^- = \left(\xi_i - \frac{i-1}{n}\right) \tag{6}$$

$d_{n,(1-\alpha)}$ – critical value of statistics Dn provided that $F_\Sigma(\xi)$ and $F_V^*(\xi)$ differ casually

In [3] it is marked, that estimation D_n under the formula

$$D_n^{/} = \max\left\{\left|D_i^+\right|\right\}; \quad 1 \le i \le n \tag{7}$$

leads to incorrect decisions on a parity $F_\Sigma(\xi)$ and $F_V^*(\xi)$.

The similar remark can be found and in [4]. The reason of such discrepancy does not stipulate. At uncertain in advance n, decrease in time of calculation, according to [3], is reached by application of exact approach Stephens, which tabulated critical values $d_{n,(1-\alpha)}$, depending from n and α, reduces to dependence only from α. Sample $\{\xi\}_n$ it is unpresentable, if

$$A \cdot D_n > C_{1-\alpha} \tag{8}$$

where:

$$A = \left(\sqrt{n} + 0.12 + \frac{0.11}{\sqrt{n}}\right) \tag{9}$$

For example, at n=4 size A=2,175 and for α=0,1 critical value $C_{1-\alpha}$=1,224, and at α=0,05 size $C_{1-\alpha}$=1,358.

Application of a method of the decision of «a return problem» when it is in advance known, that sample $\{\xi\}_n$ it is unpresentable, has shown, that criteria (1) and (8) for values most often used in practice α=0,05 and α=0,1 not casual character of divergence $F_\Sigma(\xi)$ and $F_V^*(\xi)$ at small n establish only for those cases when it does not raise the doubts. For acknowledgement of this statement, we shall consider a following example. Let random numbers ψ have uniform distribution $F_\Sigma(\psi)$ in an interval [0.5; 1]. Casual sample is set $\{\psi\}_n$ with n=4: {0,86346; 0,50672; 0,91424 and 0,67210}. Check up the assumption of imposing appearance of this sample for the uniform law of distribution of a random variable ξ in an interval [0,1].

Results of calculations are resulted in table 1.

Table 1

Example of an estimation of imposing appearance of sample

i	$F_\Sigma(\psi_i)$	i/n	D_i^+	D_i^-	The note
1	0.507	0.25	-0.257	+0.506	$D_i^+ = 0.086$; $D_i^- = 0.506$
2	0.672	0.5	-0.172	+0.422	D_n=0.506; $D_n < d_{4;\,0.9}$=0.565
3	0.863	0.75	-0.113	+0.363	AD_n=1.101;
4	0.914	1.00	+0.086	+0.164	$AD_n < C_{0.9}$=1.224

As sample follows from table 1 $\{\psi\}_4$ does not contradict the assumption of imposing appearance rather $F_\Sigma(\xi)$ at α=0,1.

These features and some assumptions of the reasons of their occurrence [5] have demanded to pass from the analysis of absolute values of the greatest divergence of distributions $F_\Sigma(\xi)$ and $F^*_V(\xi)$, to the analysis of the valid values of the greatest divergence (St_n). Thus under «the greatest divergence $F_\Sigma(\xi)$ and $F^*_V(\xi)$» we shall understand the greatest on the module vertical distance between $F_\Sigma(\xi)$ and $F^*_V(\xi)$ with i=1, n.

Calculations St_n were spent according to the algorithm, integrated which block diagram is resulted in figure 1.

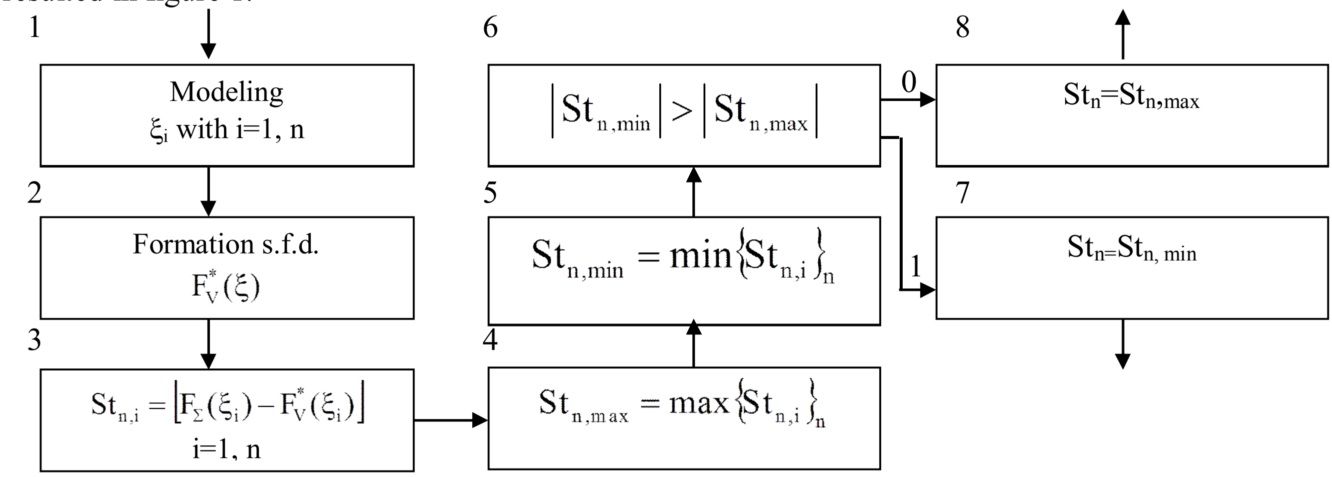

Fig.1. Block diagram of algorithm of calculation of the greatest divergence of distributions $F_\Sigma(\xi)$ and $F^*_V(\xi)$

Application of formulas of type

$$St_n = \max\left(\xi_i - \frac{i}{n}\right) \quad 1 \le i \le n \qquad (10)$$

calculation on the computer leads to erroneous results. For example, according to table 1 the maximal value among four realizations of size D_i^+ will, $D_i^+ = 0.086$, and the greatest vertical divergence between $F_\Sigma(\xi)$ and $F^*_V(\xi)$ it is equal $D_1^+ = -0.256$

Results of ordering of given realizations St_n presented in table 2 and allow concluding:

1. Quintile distributions $F^*(St_n)=\alpha$ and $n\geq2$ are equal on size and are opposite on a sign (distinction in a sign is caused by distinction of formulas 4 and 10) quintiles distributions $F(D_n)=2\alpha$ {see tabl.16 [2]};
2. Distribution $F^*(St_n)$ is asymmetrical. In the illustrative purposes on fig. 2 are resulted s.f.d. $F^*(St_n)$ for of some n. The assumption of symmetry of distribution $F(St_n)$ it is possible to explain discrepancy of probability practically equal quintile distributions $F^*(St_n)$ and $F(D_n)$;
3. Than ξ_n it is less, that negative value on sign St_n on size will be more, since $St_n=(\xi_{n-1})$. On experimental data the least value St_n for n=2 has appeared equal St_n=-0,992, and the greatest St_n=+0,489 at sup equal, accordingly, 1 and 0,5.

Table 2

Some results of an estimation s.f.d. $F^*(St_n)$

$F^*(St_n)$ / n	0,025	0,05	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	0,95	0,975
2	-0.842	-0.775	-0.684	-0.551	-0.473	-0.149	-0.363	-0.304	-0.239	-0.060	0.184	0.285	0.343
3	-0.709	-0.635	-0.566	-0.471	-0.400	-0.335	-0.296	-0.252	-0.200	-0.145	0.231	0.299	0.372
4	-0.623	-0.567	-0.494	-0.414	-0.355	-0.302	-0.253	-0.217	-0.173	0.155	0.240	0.319	0.377
5	-0.567	-0.511	-0.449	-0.370	-0.318	-0.274	-0.232	-0.190	-0.147	0.164	0.246	0.309	0.360
6	-0.523	-0.469	-0.411	-0.338	-0.292	-0.252	-0.215	-0.173	-0.127	0.171	0.244	0.303	0.358
7	-0.481	-0.438	-0.384	-0.318	-0.274	-0.235	-0.201	-0.162	-0.113	0.165	0.235	0.290	0.342
11	-0.389	-0.353	-0.309	-0.255	-0.219	-0.189	-0.110	-0.129	-0.097	0.160	0.216	0.260	0.302
16	-0.33	-0.295	-0.258	-0.215	-0.184	-0.158	-0.134	-0.103	0.107	0.150	0.194	0.232	0.264
22	-0.280	-0.253	-0.221	-0.183	-0.157	-0.135	-0.113	-0.083	0.105	0.137	0.176	0.210	0.235
29	-0.246	-0.219	-0.193	-0.160	-0.138	-0.119	-0.099	-0.068	0.098	0.126	0.158	0.186	0.212
40	-0.208	-0.187	-0.164	-0.136	-0.119	-0.102	-0.084	-0.050	0.089	0.112	0.140	0.164	0.185
60	-0.173	-0.156	-0.137	-0.114	-0.097	-0.083	-0.069	0.054	0.077	0.096	0.118	0.138	0.155
90	-0.142	-0.127	-0.111	-0.092	-0.079	-0.068	-0.055	0.051	0.067	0.081	0.100	0.116	0.130
120	-0.122	-0.110	-0.096	-0.080	-0.068	-0.059	-0.047	0.047	0.060	0.072	0.089	0.102	0.114
150	-0.110	-0.099	-0.086	-0.071	-0.062	-0.053	-0.042	0.041	0.053	0.065	0.079	0.092	0.104

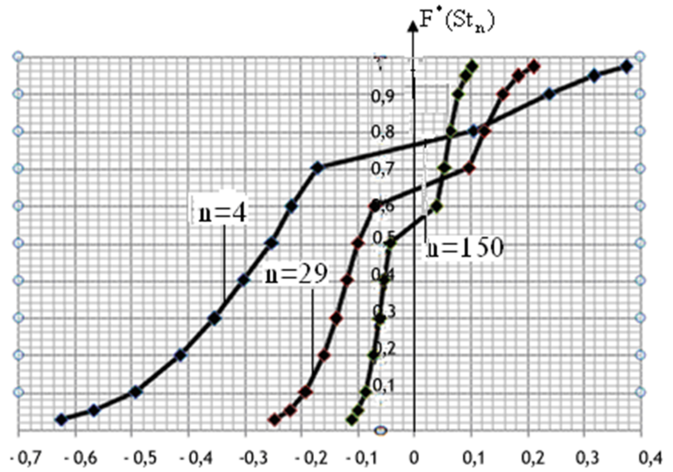

Fig.2. S.f.d. $F^*(St_n)$ for of some n

4. In distribution $F^*(St_n)$ distinguish the bottom $\underline{St}_n$ and top $\overline{St}_n$ boundary values with a significance value α, i.e.

$$\left.\begin{aligned} F^*\left(\underline{St}_n\right) &= \alpha/2 \\ F^*\left(\overline{St}_n\right) &= (1-\alpha/2) \end{aligned}\right\} \qquad (11)$$

5. It is established, that if 0,25≥$F^*(St_n)$≥0,75, i.e. if α≤0,5

$$\overline{St}_n = -\left(\frac{1}{n} + \underline{St}_n\right) \qquad (12)$$

For example, for n=4 and α=0.10 according to distribution $F^*(St_n)$ (see tabl.2) size $\underline{St}_4 = -0.567$, and $\overline{St}_4 = +0.319$. At the same time under the formula (12)

$$-(0{,}25-0{,}567=0{,}317=\overline{St}_4$$

If n=29 and α=0,2, that $\underline{St}_n = -0.193$ and $\overline{St}_n = 0.158$. The size $\overline{St}_n$ under the formula (12) is equal - (0,034-0,193)=0,159

On fig. 3 histograms of distribution of negative and positive values St_n for n=4 and n=29 are resulted.

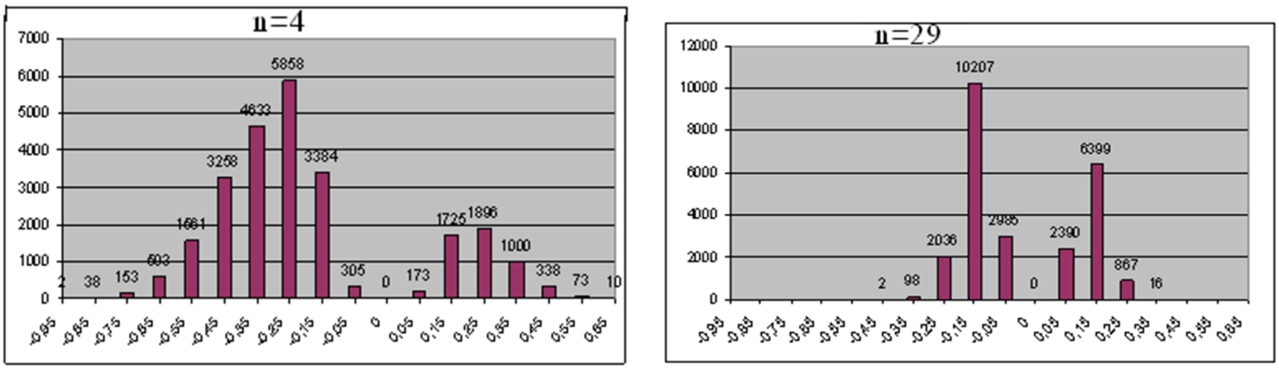

Fig.3. Histograms of distribution of the greatest divergence of distributions $F_\Sigma(\xi)$ and $F^*_V(\xi)$

As follows from fig. 3, negative values St_n essentially exceed positive values St_n on relative number and an interval of change. Proceeding from i. 3 it is clear, that it not casually and does not testify about unpresentable samples. With growth n the parity of negative and positive values St_n decreases and aspires to unit. For n=2 negative values St_n make 87,5%, and for n=29 - 61%, and for n=150 – 55%. Thus, even at n=150 quintile distributions $F^*(St_n)$ at α=0,05 and α==0,95 are not equal [-0.099; +0.092]. Histograms also explain laws of distribution $F^*(St_n)$ resulted on fig.2.

On fig. 4 curve changes of boundary values of statistics St_n for of some values s.f.d. are resulted, $F^*(St_n)$. Criterion of the control of imposing appearance of sample $\{\xi\}_n$ with a significance value α thus looks like:

$$\underline{St_n} < St_n < \overline{St_n} \qquad (13)$$

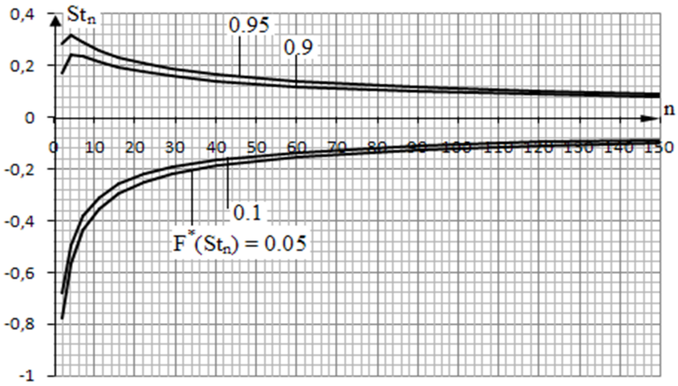

Fig.4. Laws of change of boundary values of the greatest divergence of distributions $F_\Sigma(\xi)$ and $F^*_V(\xi)$

Let's designate positive values St_n through St_n^+, and negative values- St_n^-

In view of i.1. and the equations (12), sample $\{\xi\}_n$ with a significance value $\alpha \le 0,5$ can be accepted representative, if

$$\left.\begin{aligned} St_n^+ &< \left[d_{n,(1-2\alpha)} - \frac{1}{n} \right] \\ \left| St_n^- \right| &< d_{n,(1-2\alpha)} \end{aligned}\right\} \qquad (14)$$

As

$$\left(St_n^+ + \frac{1}{n} \right) = \left| St_n^- \right|$$

criterion (13) for a significance value α can be presented, as

$$\left(\overline{St_n^+} + \frac{1}{n}\right) = \left|\underline{St_n^-}\right| = d_{n,(1-2\alpha)} \qquad (15)$$

Here it is necessary to pay attention to discrepancy of the equations of importance St_n and $d_{n,(1-2\alpha)}$.

If again to address to data of table 1 it is easy to notice, that the interval criterion (13), allowing to consider a sign on the greatest divergence St_n, also is unable to establish unpresentable character of sample $\{\psi\}_n$.

It is known, that decrease in risk of the erroneous decision at classification of data can be reached by the account not only errors I type, but also the II types [4].

The most simple decision of this problem would be comparison St_n between $F_\Sigma(\xi)$ and $F_V^*(\xi)$ with boundary values of the interval $\left[\underline{St_n};\overline{St_n}\right]$ corresponding a significance value α=0,5. It is that limiting case of values α when St_n=0. Thus a errors II type β=(1-α), i.e. also it is equal 0,5. If α to accept it is less, than 0,5 the errors II type increases β.

In real conditions:

- configurations $F_\Sigma(\xi)$ also $F_V^*(\xi)$ are various, i.e. $St_n \neq 0$;
- for the same value St_n size ($\alpha+\beta$) less or it is equal to unit;
- in process of increase St_n size ($\alpha+\beta$) decreases, reaches the minimum ($St_{n,opt}$) and then increases;
- if $St_n < St_{n,opt}$, then $\alpha>\beta$, if $St_n > St_{n,opt}$, then $\alpha<\beta$;
- distinction between α and β increases in process of increase in a divergence between St_n and $St_{n,opt}$.

Comparison of realizations St_n to boundary values $\underline{St_n}$ and $\overline{St_n}$, calculated accordingly, for $F^*(\underline{St_n}) = 0.25$ and $F^*(\overline{St_n}) = 0.75$, allows to not calculate s.f.d., which defines a errors II type β, that it is possible to carry to advantages of this way. Its lacks are necessity of increase twice numbers of modeled realizations of distribution $F_V^*(\xi)$, unjustified decrease in disorder St_n, the heuristic approach.

Algorithm of calculation s.f.d., describing the greatest deviation $F_\Sigma(\xi)$ and $F_V^*(\xi)$, provided that $F_V^*(\xi)$ it is unpresentable, consists of following sequence of calculations:

1. It is modeled next (from necessary N realizations) their sample n random numbers;
2. It is formed s.f.d. $F_V^*(\xi)$;
3. The greatest divergence between F is defined $F_\Sigma(\xi)$ and $F_V^*(\xi)$. Designate this size as $St_{n,e}$ where the index «e» corresponds to empirical character of sample.
   Having defined statistical characteristics of this sample $\{F_V^*(\xi)$ and $St_{n,e}\}$, start formation s.f.d. $F^*(St_n^*)$ on realizations of the greatest divergence between functions of distribution $F_\Sigma(\xi)$ and set (N) s.f.d. $F_V^*(\psi)$, modeled on s.f.d. $F_V^*(\xi)$. For what:
4. On s.f.d. $F_V^*(\xi)$ distribution is formed

$$F_V^*(\psi) = \begin{cases} 0 & \text{if } \psi \le \psi_1 \\ \dfrac{i-1}{n+1} + \dfrac{(\psi-\psi_i)}{(\psi_{i+1}-\psi_i)(n+1)} & \text{if } \psi_1 < \psi < \psi_{n+1} \\ 1 & \text{if } \psi \ge \psi_{n+1} \end{cases} \qquad (16)$$

5. Under standard program RAND the random number is modeled ξ with uniform distribution in an interval [0,1];

6. On distribution (16) calculated corresponding probability ξ random number ψ. Calculations are spent under the formula
$$\psi = \psi_i + (\psi_{i+1} - \psi_i)[\xi \cdot (n+1) - (i-1)] \quad (17)$$
with $i=1, (n+1)$
7. Items 5 and 6 repeat n time;
8. On sample $\{\psi\}_n$ is under construction s.f.d. $F^*_V(\psi)$;
9. The greatest divergence between $F_\Sigma(\xi)$ and $F^*_V(\psi)$ is defined. Designate it through St^*_n;
10. Items (5÷9) will repeat N time;
11. Average value of a random variable St^*_n defined. Designate it through $M^*(St^*_n)$;
12. On N to values, St^*_n it is formed s.f.d. $F^*(St^*_n)$.

If to assume, that distribution $F^*(St^*_n)$ corresponds to the normal law of distribution, average value $M^*(St^*_n)$ is equal $St_{n,e}$ and corresponds $F^*(St^*_n) = \beta = 0{,}5$, for all realizations $St_{n,e}$, which probability $0.1<\alpha<0.5$, the preference should be given to assumption H_2. However, the assumption of the normal law of distribution of function $F^*(St^*_n)$ mismatches the validity. As an example on fig.5 the histogram of distribution of realizations St^*_n for s.f.d. is resulted. $F^*_V(\psi)$, resulted in table 1.

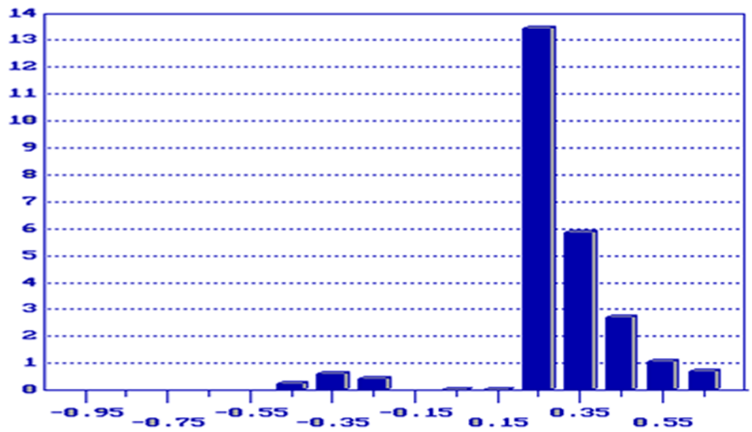

Fig.5. Histogram of realizations St^*_n

Let's enter into consideration two assumptions:
H_1 - sample $\{\psi\}_n$ reflects laws of distribution $F_\Sigma(\xi)$;
H_2 - sample $\{\psi\}_n$ does not reflect law of distribution $F_\Sigma(\xi)$.

The recommended algorithm of decision-making depends on a parity of average values of realizations St_n and St^*_n. In this connection the distribution describing risk of the erroneous decision in function St_n designate $Sh1(St_n)$, and in function St^*_n – $Sh2(St_n)$.

At $M^*(St_n) < M^*(St^*_n)$
$$\left.\begin{aligned} Sh1(St_n) &= 1 - F^*(St_n) \\ Sh2(St_n) &= F(St^*_n) \end{aligned}\right\} \quad (18)$$
Algorithm of decision-making looks like:
$$\left.\begin{aligned} &\text{If} St_{n,э} \geq \overline{St_n}\text{, then } H_2\text{, else} \\ &\text{If} St_{n.э} \leq \underline{St^*_n}\text{, then } H_1\text{, else} \\ &\text{If} Sh1(St_n) << Sh2(St_n)\text{, then } H_2, \\ &\text{Otherwise } H_1 \end{aligned}\right\} \quad (19)$$

At $M^*(St_n) \geq M^*(St_n^*)$

$$\left.\begin{aligned} Sh1(St_n) &= 1 - F^*(St_n^*) \\ Sh2(St_n) &= F^*(St_n) \end{aligned}\right\} \qquad (20)$$

Algorithm of decision-making looks like:

$$\left.\begin{array}{l} \text{If} St_n \geq \overline{St_n^*}\text{, then } H_1\text{, else} \\ \text{If} St_{n,э} \leq \underline{St_n}\text{, then } H_2\text{, else} \\ \text{If} Sh1(St_n^*) >> Sh2(St_n)\text{, then } H_2\text{,} \\ \text{Otherwise } H_1 \end{array}\right\} \qquad (21)$$

In the illustrative purposes on fig. 6 functions of distribution $Sh1(St_n)$ and $Sh2(St_n)$ are resulted. calculated according to table 1.

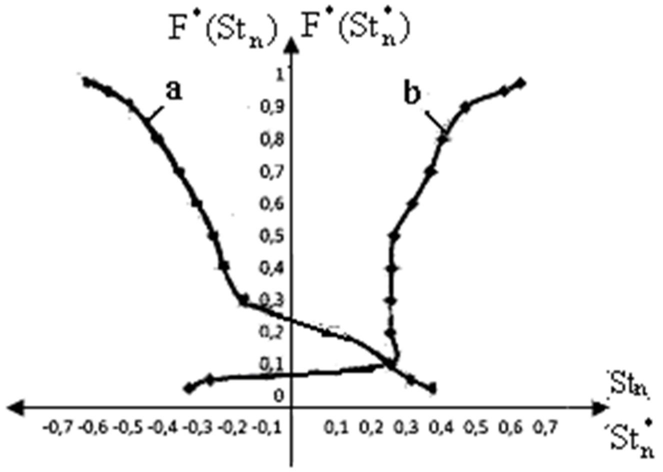

Fig. 6. Laws of change s.f.d. $F^*(St_n)$ and $F^*(St_n^*)$ for n=4: a – s.f.d. $F^*(St_n)$; b - $F^*(St_n^*)$

As $M^*(St_n)$ it has appeared less than $M^*(St_n^*)$ functions of distribution $Sh1(St_n)$. and $Sh2(St_n)$. were calculated accordingly under the formula (18).

In table 3 numerical values of the parameters defining result of the decision are systematized. As follows from tab. 3 as $Sh1(St_{n,e}) << Sh2(St_{n,e})$., the preference, according to (19) is given assumption H_2. In other words, attraction to the statistical analysis of size of a errors I type and errors II types, allows distinguish unpresentable samples.

Table 3

The basic parameters of calculation

Parameter	Conditional designation	Estimation
1. Number casual sample	n	4
2. Average value of the greatest divergence of distributions $F_\Sigma(\xi)$ and $F_V^*(\xi)$	$M^*(St_n)$	-0,207
3. Average value of the greatest divergence of distributions $F_V^*(\psi)$ and $F_V^*(\psi)$	$M^*(St_n^*)$	0,292
4. Empirical value of the greatest divergence of distributions $F_\Sigma(\xi)$ and $F_V^*(\xi)$	$St_{n,e}$	0,257
5. Boundary values of an interval of change St_n c α=0.1		
top	$\overline{St_n}$	
bottom	$\underline{St_n}$	
6. Boundary values of an interval of change St_n^* with α=0,01		0,319
top		-0,567

bottom	$\overline{St^*_n}$	0,544
7. Probability $St_{n,e}$ on s.f.d. $[1-F^*(St_n)]$	$\underline{St^*_n}$	
on s.f.d. $F^*(St^*_n)$	$Sh1(St_{n,e})$	0,292
8. The assumption is accepted	$Sh2(St_{n,e})$	0,09
	H	0,42
		H_2

It is necessary to note, that attraction to an estimation of character of a divergence of distributions $F_\Sigma(\xi)$ and $F^*_V(\psi)$ distributions $F^*(St^*_n)$ for all realizations samples it is unjustified, as for of some from them, for example at $Sh1(St_n).\geq 0,5$ sample $\{\psi\}_n$ it is most truly representative, and at $Sh1(St_n)\leq 0,1$ – it is unpresentable.

There fore calculations s.f.d. $F^*(St^*_n)$ offered to spend for following conditions:

1. $M^*(St_n) < M^*(St^*_n)$

$$\left.\begin{array}{l} \underline{St^*_{n,0.05}} < St_{n,э} < \overline{St_{n.0.95}} \\ \underline{St^*_{n,0.25}} \geq St_{n,э} \geq \overline{St_{n.0.75}} \end{array}\right\} \qquad (22)$$

2. $M^*(St_n) > M^*(St^*_n)$

$$\left.\begin{array}{l} \underline{St_{n,0.05}} < St_{n,э} < \overline{St^*_{n,0.95}} \\ \underline{St_{n,0.25}} \geq St_{n,э} \geq \overline{St^*_{n,0.75}} \end{array}\right\} \qquad (23)$$

Critical values of statistics St_n for $F^*(St_n)=0,25$ and average values $M^*(St_n)$ for N=25000 realizations St_n and of some n are resulted in table 4.

Table 4

Bottom boundary $(\underline{St_n})$ and average $M^*(St_n)$ values of statistics St_n

N	n	St_n ($F^*(St_n)$=0.25)	$M^*(St_n)$	N	n	St_n ($F^*(St_n)$ =0.25)	$M^*(St_n)$
1	2	-0.498	-0.33	9	22	-0.17	-0.047
2	3	-0.435	-0.254	10	29	-0.149	-0.037
3	4	-0.385	-0.207	11	40	-0.127	-0.027
4	5	-0.343	-0.173	12	60	-0.105	-0.019
5	6	-0.312	-0.146	13	90	-0.086	-0.012
6	7	--0.294	-0.133	14	120	-0.074	-0.00-
7	11	-0.235	-0.87	15	150	-0.067	-0.008
8	16	-0.198	-0.063				

The computer technology of an estimation of parameters of individual reliability assumes automation of process of classification of multivariate data. For what, as initial data boundary values of statistics St_n should entered. In this connection, by analogy to formulas (8) and (9), the opportunity of an estimation of dependence of boundary values St_n from n was of interest.

The equations of regress received under the standard program of sedate transformation, are characterized by factor of determination R2: (R2> 0.999) and for of some $Sh1(St_n).=\alpha/2$ look like:

- for $Sh1(\overline{St_n}) = 0,025$ $\qquad \overline{St_n} = (1.23n^{0.52}-1)/n = (B_1 n^{0.52}-1)/n \qquad$ (24)

  and $Sh1(\underline{St_n}) = 0,975$ $\qquad \underline{St_n} = -1.23n^{-0.48} = -B_1/n^{0.48} \qquad$ (25)

- for $Sh1(\overline{St_n}) = 0,05$ $\qquad \overline{St_n} = (1.12n^{0.52}-1)/n = (B_2 n^{0.52}-1)/n \qquad$ (26)

and $Sh1(\underline{St_n}) = 0{,}95$ $\qquad \underline{St_n} = -1.12n^{-0.48} = -B_2/n^{0.48}$ (27)

- for $Sh1(\overline{St_n}) = 0{,}1$ $\qquad \overline{St_n} = (0.98n^{0.52} - 1)/n = (B_3 n^{0.52} - 1)/n$ (28)

and $Sh1(\underline{St_n}) = 0{,}9$ $\qquad \underline{St_n} = -0.98n^{-0.48} = -B_3/n^{0.48}$ (29)

- for $Sh1(\overline{St_n}) = 0{,}25$ $\qquad \overline{St_n} = (0.75n^{0.52} - 1)/n = (B_4 n^{0.52} - 1)/n$ (30)

and $Sh1(\underline{St_n}) = 0{,}75$ $\qquad \underline{St_n} = -0.75n^{-0.48} = -B_4/n^{0.48}$ (31)

The equation of dependence of constant factors B from α with factor of determination R2: (R2> 0.993) looks like:

$$B = 0.652\left[Sh1\left(\overline{St_n}\right)\right]^{-0.175} \tag{32}$$

Thus, the bottom and top boundary values of statistics St_n in view of the equation (12) calculated under following formulas:

$$\begin{aligned} \underline{St_n} &= -0.652\left[Sh1\left(\overline{St_n}\right)\right]^{-0.175} \cdot n^{-.048} \\ \overline{St_n} &= -\left[\underline{St_n} - \frac{1}{n}\right] \end{aligned} \tag{33}$$

For practical calculations $\underline{St_n}$ and $\overline{St_n}$ more often formulas (27) and (12) used.

CONCLUSIONS

1. The interval nonparametric criterion of the control of conformity samples from n pseudo-random numbers is offered to the uniform law in an interval [0,1];
2. In a basis of criterion there is a distinction of distributions of positive and negative values of the greatest divergence of distributions $F_\Sigma(\xi)$ and $F_V^*(\xi)$;
3. Transition from statistics D_n to statistics St_n allows not only to simplify algorithm of calculation greatest divergences $F_\Sigma(\xi)$ and $F_V^*(\xi)$, but also to estimate an opportunity of use of statistics St_n at an estimation of the greatest divergence s.f.d. $F_\Sigma^*(X)$ and $F_V^*(X)$, to estimate risk of the erroneous decision $Sh1(St_n)$;
4. Increase of accuracy of the control of conformity of distribution St_n^* to the uniform law reached by practical realization of recommended algorithm of the decision-making considering not only a errors I type, but also the errors II type.

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