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I.V. Ruzhentsev, S.V. Lutskiy, V.P. Fetkiv, A.I. Podzigun

Kharkiv National University of Radioelectronics, Kharkiv

DISCRETE PROBABILISTIC INFORMATION LAWS FACTOR OF EFFICIENCY

The article is dealing with the application of system and informational approach to the analysis of dimension integration, which enhances technical and economic factors of production.

***Key words**: technical, economic, engineering, and manufacturing factors, sampled stochastic data, technology, systems, processes, product.*

Introduction

Modern needs of the society for new industrial products have given rise to the efficiency of machinery production under condition of the product frequent turnover. The task to reduce lead-time of the technological processing and technological staging, and to improve quality and project design is now coming to the fore.

The concept of integrated production has brought out the manufacturing activity in machinery to a new dialectic development that originates in automation of working cycle in self-generating, self-renewing, and self-organizing manufacturing systems [1].

Recent Findings

Each kind of resource, before it may be used in a specific technical process, undergoes a range of transformations, determined by its production cycle. The full integration of production at the stages of the product life cycle is a combination of the necessary production stages into a single production system on the base of the control computer. The increasing role of information, underlying the resource management, provides for the high level of engineering technology. System and informational approach is an approach to studies of data flows in technological processes and systems in terms of fundamental concepts of information. The main concept of the system and informational (SI) approach is amount of discrete probabilistic (DP) information. The amount of SS data of the production process is characterized by its order, and is one of the most important characteristics of technical and economic efficiency of this process. Research of DP processes in integrated engineering is of particular importance since DP information is the only substance in contrast to matter and energy that combine all stages of the article life cycle.

SI approach to study of processes and systems as a field of study is based on the following: [2]

a) developed concept of the DP information notion;
b) methodology of numerical definition of amount, quality, and value of DP information;
c) scientific principles of DP information algebra;
d) stipulated laws and regularities of DP information;
e) DP approach methodology to processes and systems modelling;
f) sampled-stochastic models (DP-models) of processes and systems;
g) DP approach methodology to the processes and systems analyses and syntheses;
h) methodology of critical technology developments on the basis of DP-models of processes and systems.

The following scientific provisions underlie the SI approach methodology:

a) any elementary deviation from fundamental attributes in the universe entails number of effects of elementary “reflections”;
b) the universe is a “system of reflections” $\delta(m,e,i,t,r) \rightarrow \{\delta o\}$,

with $\delta m, \delta э, \delta i, \delta t, \delta r$, – elementary: mass, energy, information, time, space; $\{\delta o\}$ – number of effects of elementary “reflections”;

c) elements of “reflection system” are inherently sampled, they are the least sensitivity

thresholds of categorical attributes to each other.

Sampling rate of space is provided by final values of fundamental physical constants that connect all processes of the physical world.

The fundamental methodology issue is determination of the ratio of data amount measure on the Shannon-Boltzmann (classical theory of communication information) and DP approach.

The published works theoretically prove [2] that for every known law of stochastic distribution the amount of data under SI approach is calculated according to the formula $I_{ÄÂ} = \log_2 X_i - \log_2 \Delta x_i$, with $\log_2 X_i$ - deterministic part, and $\log_2 \Delta x_i$ – stochastic part of equation (X – i-rated value, Δx_i – stochastic deviation of the rated value).

The SI approach allows to calculate the amount and value of the object data.

DP information quality of the object is defined as a general characteristic found in the relative deviation from the set of target properties of the object form the real ones.

DP information value is defined as positive or negative effects of the essential properties of object A to the extent of forming a plurality of target properties of object B and its values.

Aim and Tasks

Defining regular relations of technical, economic, manufacturing and technological factors and DP information of processes and systems at the stages of the article life cycle, providing increase in efficiency.

Main Points

The mentioned provisions of SI approach are based on the physical laws of conservation and processes and systems development, which are based on fundamental property of physical space – "reflection". The German physicist M. Planck in the early 20th century showed that elementary values of basic units (δl,δt,δm,δэ,δi – elementary deviations of categorical attributes that posses its lowest values in real world) may be compiled and calculated from fundamental physical constants – C=299792458 m/s, (light speed); h=6,626075 10(-34) J s, (Planck constant); G=6,67259 10(-11) m(3) / kg s(2), (gravitation constant).

$$\delta r = \sqrt{\frac{Gh}{C^3}} = 1{,}6 \times 10^{-35^M};$$

$$\delta_r = \sqrt{\frac{G_h}{C^5}} = 5{,}4 \times 10^{-44^c}; \quad \delta_m = \sqrt{\frac{G_h}{C^5}} = 2{,}2 \times 10^{-8kg};$$

$$\delta_э = \frac{h}{\Delta_r} = 1{,}22705 \times 10^{-38} J$$

$$\delta_i = \log_2 2 = 1bit \leftrightarrow 0\acute{o}6931418nit^{nit}. \quad (1)$$

Table 2 shows the calculation of numerical value of decimal system unit and accuracy in DP information mode.

Table 1.

Attribute unit	Amount of DP information in decimal system unit [bit]	Accuracy of attribute unit in decimal system unit
Space (Rn) [1m]	$I = \log_2 \frac{1}{1{,}6162 \times 10^{-35}} = 115{,}575$	1m+Δ = 1,000004515
Time (t) [1s]	$I = \log_2 \frac{1}{5{,}39121 \times 10^{-44}} = 143{,}734$	1s+Δ = 1,000032045
Matter (m) [1kg]	$I = \log_2 \frac{1}{2{,}1761 \times 10^{-8}} = 25{,}454$	1kg-Δ = 0,9998087167
Energy (E) [1J]	$I = \log_2 \frac{1}{1{,}054572 \times 10^{-34}} = 112{,}869$	1J +Δ=1,000246803

We will provide an example of energy unit 1J calculating based on the mentioned DP information laws.

Example:

According to the SI, energy unit J equals:

$$\left[J = kg \frac{m^2}{s^2} \right]$$

We will introduce in the form of DP information equation:

ln 1J = ln(δkg / δJ 1kg) + 2ln(δm/δJ 1m) - 2ln(δs /δJ 1s).

We will introduce DP information equation of energy 1J in numerical form from the Table 1 and 2:

112,869 = (4,434x25,454) + (0,977x115,575) + (0,977x115,575) – (0,786x143,734) – (0,786x143,734) = 112,869.

The example states: 1) existence of the law of conservation of DP information in nature, which is derived from the energy conservation law; 2) DP information of SI units may be equated or equivalently evaluated by DP information of energy that becomes the most objective relative numerical measure of properties of physical objects.

The SI approach distinguishes a range of technical and economic regularities that may be used for scientific and applied issues.

1. The amount of DP information of the object truly characterizes its complexity and is equivalently to such characteristics as cost, production expenses, maintenance of technical objects, quality of consumer requirements etc.
2. The quality of DP information of the object characterizes the quality of technological production process of technical objects.
3. The value of DP information of the object truly characterizes efficiency of production facilities.

In our theoretical and experimental research we discovered production, technology, and DP information regularities.

1. Any production method is manifested through a system of DP information relations in production objects.

The production object has a finite amount of DP information that objectively reflects the amount of work invested in it while creation.

The less amount of DP information provides for operational assignment of the object, the more efficient its creation is.

2. Cost of physical, labour and energy production resources is correlated with the amount of data in the system of DP information relations of objects participating in technological process.
3. The quality characteristics of the manufactured product are correlated with the value of losses or excess of the data amount in the system of DP information relations of objects participating in technological process.
4. Efficiency characteristics are correlated with the values of quality and significance of DP information relations of objects participating in technological process.

Discovered by SI approach methodology regular DP relations of matter energy and information may be used in solving various tasks of public activity: science, engineering, maintenance of technical objects, economy, environmental protection, medicine etc.

Conclusions

1. Units of International System in DP information representation are interrelated through the coefficient of data communication rate $\delta A/\delta B$.
2. Definition of technical, economic, industrial, and technological performance on the basis of DP processes and systems allows to use the mentioned method in resource management and production efficiency.

References

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