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ENTROPY PARADIGM IN THE THEORY OF HIERARCHICAL ACTIVE SYSTEMS. ELEMENTS OF CONFLICT THEORY

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Abstract

It is proposed a variant of the theory of active hierarchical systems. The variant is based upon the subjective entropy maximum principle [3, 4], which, from the formally-mathematical point of view, coincides with the principle of Jaynes-Gibbs [1, 2]. The mentioned principle rests upon the notion of subjective entropy, the principle of an „individual bearer", and scheme of preferences aggregation; and, in this sense, the principle is an independent one.

A model of preferences hierarchy is built for the distributions of objects and ratings preferences. It is used a property of the hierarchical additivity of entropy in the Shannon's form.

The theory of conflicts, as conflicts of preferences distributions, is developed on the basis of this model. It is proposed a classification of conflicts that reflects to a significant degree the existing knowledge in this field. A conflict transformation from one phase into another is connected with the overcoming of some certain entropy thresholds. It is considered the dynamics of conflicts, intrapersonal and interpersonal conflicts.

The given theory, in our opinion, is an actual one at the study of the active systems safety problems including the problem of flight safety since an aviation transportation system, as a whole, and the system of „Aircraft-Pilot-Environment", in particular, are active systems.

The formalization developed here is the effective means of the problems solutions where the active system is in the situation of a choice from a certain set of alternatives S_a.

If we look closer, we will find that practically at each aviation incident that or another conflict takes place.

We will try to disclose the term „active system" later [6, 7, 8, 9, 10, 11, 12, 13, 14, 17, 18]. Here we will just refer to the statement by the philosopher Berdiayev N.A. [15] „The source and sense of Russian communism":

„The source of motion is inside, but not in the outside thick, coming from the outer space, as it is thought by the mechanical materialism, real freedom is intrinsic to the matter, there is a source of activity in the matter's entrails/depth, the source changes the environment".

This point of view unisons with that authors think of. The task, in the given case, is to interpret it in the terms of the entropy paradigm, meaning the subjective entropy.

INTRODUCTION

The research results are represented in the two papers: the first paper: „Entropy paradigm in the theory of hierarchical active systems, elements of conflict theory" and the second paper: „Control in a hierarchical active system on the basis of entropy paradigm of subjective analysis".

About subjective entropy maximum principle

Development of the entropy theory of active hierarchical systems is an actual task of „subjective analysis" [3, 4, 5].

The fundamental principle is the **„subjective entropy maximum principle"** (SEMP), the mathematical formulation of which coincides with the formulation of the principle by Jaynes-Gibbs [1, 2], in its essence SEMP significantly differs from the latter although; and, being applied to modelling psych manifestations, SEMP is an independent principle in fact. Its main suppositions are reduced to the following:

1. There is a not empty set of alternatives S_a.

The number of alternatives is always more than 1. Thus, the subject is constantly in the situation of choice.

2. The psych forms the distribution of the preferences on the set of the alternatives.

The appointed distributions are formed in an optimal way. The subjective entropy of the preferences is determined on the set S_a. The distribution of the preferences maximizes the subjective entropy on the variety given by „isoperimetrical" conditions.

3. The psych has an ability to aggregate the preferences.
4. There are the two types of preferences: objects $\left(\pi(\sigma_i)\right.$, where $\sigma_i \in S_a$ – the preferences of the alternatives, $\left. i \in \overline{1,N}\right)$ and ratings $\left(\xi(j)\right.$, where j – index of the subject from the group S_ξ; $\left. j \in \overline{1,M}\right)$.
5. There are certain levels (thresholds) of the subjective entropy that determine the structure of the entropy space. A transition through the thresholds relates to the quality and skip shaped quantity change of the psych state, for example, – the change in the number of the considered alternatives σ_i and, correspondingly, dimensions of the set S_a $\left(\text{or } S_\xi\right)$.

Thus, the functional by Jaynes represents by itself a „mathematical wrap" for a new content. The attributes of psych, by which the considered principle operates, are: the sets of the alternatives; the distributions of the objects (the I[st] kind) and ratings (the II[nd] kind) preferences; cognitive functions, depending upon endogenous and exogenous factors; entropy thresholds.

The widely known laws of individual psych: Weber-Fechner, Yerkes-Dodson, Stevens, Zabrodin, and others are taken into consideration when developing the cognitive functions.

The model of two-level system

The theory of the hierarchical systems functioning, in the framework of the entropy paradigm, is deemed to be an important one first of all because of that any groups of subjects, from the smallest up to the biggest, have a hierarchical structure and the ability to self-organization. A bright example is the hierarchization of the structure of the „flees" community, being led out of Egypt by Moses, who replaced the two-level structure with the nine-level with a significant reduction of the organizational entropy. The problems solving in the active systems have, as a rule, hierarchical structure that leads to the hierarchization of the social group involved into a corporative problem solution.

One of the main statements in the theory of the active systems is an assumption about the ability of an individual psych to realise an aggregation of both objects and ratings preferences. The mathematical differences of the processes of the aggregation are considered as more or less true presumptions each time.

Besides the principle by Jaynes-Gibbs, it is actual, at the development of the hierarchical systems models, the principle of maximum of the subjective information of a connection (Linsker's „Infomax" principle) [16]. In our case, this principle, as well as the principle by Jaynes-Gibbs, undergoes a certain transformation.

Let us confine ourselves to consideration of a two-level hierarchical system (fig. 1).

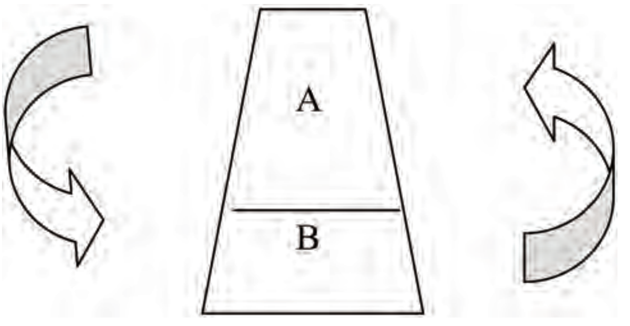


Fig. 1

Here A – subject of the top level; B – subject of the lower level.

It is necessary to reflect this circumstance in the models that we are trying to develop – the relationships of subordination, prevailing/domination in the structure of the functionals and preferences.

Let $S_a(A)$ – set of the objects alternatives of the subject A: σ_{Ai}, $i \in \overline{1, N_A}$; $S_a(B)$ – set of the alternatives of the subject B. It is naturally to reckon that the relationships between $S_a(A)$ and $S_a(B)$ can be different. If $S_a(A) \cap S_a(B) = \emptyset$, subjects A and B do not have common interests and therefore do not compile a system. If $S_a(A) \cap S_a(B) \neq \emptyset$, then we can say about the system. In this case we will take $S_a = S_a(A) \cap S_a(B)$ and consider the distributions of the preferences $\pi_A(\sigma_i)$ and $\pi_B(\sigma_i)$ at the intersection S_a. If the power of S_a is N, then the normalizing conditions will be the equations of:

$$\sum_{i=1}^{N} \pi_A(\sigma_i) = 1 ; \ \sum_{i=1}^{N} \pi_B(\sigma_i) = 1 . \tag{1}$$

It is not excluded the variant when the normalizing of objects preferences is realized at each of the individual sets of alternatives:

$$\sum_{i=1}^{N_A} \pi_A(\sigma_i) = 1 ; \ \sum_{i=1}^{N_B} \pi_B(\sigma_i) = 1 .$$

The attitude of the subject to the alternatives contained in the intersection S_a, that is to the corporative alternatives, can depend upon the presence of other „strange" alternatives in the individual corresponding problem set.

In the utility theory, it is often required the independence from the strange alternatives, if one mentions of an individual subject applicably to a group of interacting subjects, then the binding of that requirement is not obvious. In the presented paper, we a priory will believe the sets $S_a(A)$ and $S_a(B)$ coinciding.

Elements of entropy theory of conflicts

One of the forms of interactions in a system is conflicts.

At the subjective level, a conflict is interpreted as a conflict of the distribution of the preferences. There considered the following types of conflicts and, respectively, models of conflicts:

- Intrapersonal conflicts – it is „conflicts" between different types of distributions belonging to the given subject [3, 5]: $\pi^+(\sigma_i)$, $\pi^-(\sigma_i)$; $v^+(\sigma_i)$, $v^-(\sigma_i)$. Here $\pi^+(\sigma_i)$ – preference to accept (choose) the alternative σ_i, on the basis of the positive analysis; $\pi^-(\sigma_i)$ – preference to accept σ_i, on the basis of the negative analysis; $v^+(\sigma_i)$, $v^-(\sigma_i)$ – preferences to reject the alternative σ_i.
- Intrapersonal conflict between the distributions of ratings of members of the group from the point of view of the „given subject" and distributions of ranks: between $\xi(j|A)$ and $\eta(j)$.
- Interpersonal conflicts – it is „conflicts" between one-type the distributions pertaining to different subjects: for instance, a conflict between $\pi_A^+(\sigma_i)$ and $\pi_B^+(\sigma_i)$.
- Multiple (social) conflicts.
- Productive (creative) conflicts.
- Counterproductive (destroying) conflicts.
- „Cold conflicts" – when „muses say".
- „Hot conflicts" – when „cannons say".

The theory of conflicts assumes its application to solving a series of problems:

- Prediction of conflicts.
- Diagnostics (detection), determination of the type, stage, and depth (acuteness) of conflicts.
- Preventive measures against conflicts.
- Control at the stage of a conflict to be about to happen.
- Control at the stage of a conflict solving.
- Transformation of a conflict of one type into a conflict of another type.

Let us continue the formal description of hierarchical systems and conflicts.

In addition to the absolute distributions of the objects preferences (I[st] kind) $\pi_A(\sigma_{k1})$ and $\pi_B(\sigma_{k2})$; $k_1 \in \overline{1, N_A}$; $k_2 \in \overline{1, N_B}$, at the sets of, correspondingly, S_{aA} and S_{aB}, it is determined the conditional objects preferences of the two types:

$$\pi_A(\sigma_{i1}|\sigma_{k1});\ \pi_B(\sigma_{i2}|\sigma_{k2}), \tag{2}$$

and the crossed conditional preferences:

$$\pi_A\left(\sigma_{i1}\middle|\sigma_{k2}\right);\ \pi_B\left(\sigma_{i2}\middle|\sigma_{k1}\right). \tag{3}$$

With the normalizing condition

$$\left.\begin{aligned} &\sum_{i_1=1}^{N_A}\pi_A\left(\sigma_{i1}\middle|\sigma_{k1}\right)=1 \qquad \forall k_1\in\overline{1,N_A};\\ &\sum_{i_2=1}^{N_B}\pi_B\left(\sigma_{i2}\middle|\sigma_{k2}\right)=1 \qquad \forall k_2\in\overline{1,N_B}.\end{aligned}\right\} \tag{4}$$

$$\left.\begin{aligned} &\sum_{i_1=1}^{N_A}\pi_A\left(\sigma_{i1}\middle|\sigma_{k2}\right)=1 \qquad \forall k_2\in\overline{1,N_B};\\ &\sum_{i_2=1}^{N_B}\pi_B\left(\sigma_{i2}\middle|\sigma_{k1}\right)=1 \qquad \forall k_1\in\overline{1,N_A}.\end{aligned}\right\} \tag{5}$$

Distributions (2) are given at the Descartes product $S_{a1}*S_{a1}$ and $S_{a2}*S_{a2}$; preferences (3) – at the Descartes product $S_{a1}*S_{a2}$ and $S_{a2}*S_{a1}$.

We will also need the „two-point" distributions:

$$\pi_A\left(\sigma_{i1},\sigma_{k1}\right);\ \pi_B\left(\sigma_{i2},\sigma_{k2}\right), \tag{6}$$

that are being determined as the preferences of the one-step „ways" (transitions):

$$\sigma_{i1}\to\sigma_{k1};\ \sigma_{i2}\to\sigma_{k2}, \tag{7}$$

(index „1" attributes the given alternative to the subject A, set S_{aA}; index „2" – to the subject B, set S_{aB}); as well as the mixed „two-point" distributions:

$$\pi_A\left(\sigma_{i1},\sigma_{k2}\right);\ \pi_B\left(\sigma_{k2},\sigma_{i1}\right), \tag{8}$$

These distribution are individualized, that is „pertain" either A or B and characterize, for example, for A the situation when A prefers σ_{i1} and B – prefers σ_{k2}.

If there are transitions (7), then function (6) is not symmetrical with respect its own arguments in general case and there are relationships:

$$\sum_{j_1=1}^{N_A}\pi_A\left(\sigma_{i1},\sigma_{j1}\right)=\pi_A\left(\sigma_{i1}\right), \tag{9}$$

$$\sum_{i_1=1}^{N_A}\pi_A\left(\sigma_{i1},\sigma_{j1}\right)=\pi_A\left(\sigma_{j1}\right); \tag{10}$$

it is postulated the relationship:

$$\pi_A\left(\sigma_{i1},\sigma_{j1}\right)=\pi_A\left(\sigma_{i1}\right)\cdot\pi_A\left(\sigma_{j1}\middle|\sigma_{i1}\right). \tag{11}$$

Since distributions of preferences are not probabilistic distributions, the relationships like (11) have to be postulated. At this, in the general case, $\pi_A(\sigma_{i1}, \sigma_{j1})$ is not symmetrical:

$$\pi_A(\sigma_{i1}, \sigma_{j1}) \neq \pi_A(\sigma_{j1}, \sigma_{i1}),$$

that is the transitions $\sigma_{i1} \to \sigma_{j1}$ and $\sigma_{j1} \to \sigma_{i1}$ are not equally preferable. However

$$\pi_A(\sigma_{j1}, \sigma_{i1}) = \pi_A(\sigma_{j1}) \cdot \pi_A(\sigma_{i1} | \sigma_{j1}). \tag{12}$$

The relationships

$$\pi_A(\sigma_{i1}, \sigma_{k2}) = \pi_B(\sigma_{k2}) \cdot \pi_A(\sigma_{i1} | \sigma_{k2}), \tag{13}$$

$$\pi_B(\sigma_{k2}, \sigma_{i1}) = \pi_A(\sigma_{i1}) \cdot \pi_B(\sigma_{k2} | \sigma_{i1}). \tag{14}$$

are postulated in an analogous way.

Here, the conditional and unconditional distributions „belong" to the different bearers.

As everywhere in this work, it is applied the hypothesis of the „complete mutual informativity of the subjects A and B about their preferences" and complete certainty of the preferences.

The postulate about the complete informativity and certainty is never accomplished naturally.

It has a simplification character. The refusal of that assumption would require an application of some model of a non-additive measure. (model Sugeno and others ... [19,20, 21]). It is deliberately in the presented paper the task of a conflict model development for wittingly unrealisable conditions is put. An improvement of the model by the way of the non-additive measure factor taking into account is the next step.

It is easily to see that for the formulae presented above the normalizing conditions are accomplished. In a more general case it should be taken into account systems with a large number of levels. As far back as the Roman emperor Diocletian who established the „table of ranks" that has 14 ranks for officials. In Russia, the emperor Peter the I[st] adopted the „table" of Diocletian, and it preserved almost unchanged up until now.

We see the two ways of the rank structuring for an organizational system: the first – imposing a rank structure „from the top" in an administrative order, it is accompanied with a code of rules for the structure functioning; the second – emergence a rank structure as a result of a self-organization process, in this case there appears a differentiation of the ratings.

Some models of such self-organizing rating structures are described in [5]. The coming up distribution of the ratings fixes in the view of the rank distribution through the mechanisms of self-organization afterwards.

The subjective entropy maximum principle (SEMP) in the simplest form consists of the two postulates.

The first postulate: The distribution of the preferences of the first kind is formed in the psych in an „optimal" way so that the functional for the subject A

$$\Phi_\pi^{(A)} = -\sum_{i_1=1}^{N_A} \pi_A(\sigma_{i1}) \ln \pi_A(\sigma_{i1}) \pm \beta_\pi^{(A)} \sum_{i_1=1}^{N_A} \pi_A(\sigma_{i1}) F_A(\sigma_{i1}) + \gamma_\pi^{(A)} \sum_{i_1=1}^{N_A} \pi_A(\sigma_{i1}), \tag{15}$$

where $F_A(\sigma_{i1})$ – „cognitive" objects function takes an extreme value.

The distribution of the preferences of the II[nd] kind, by the assumption, is a corollary of an extremization of the functional

$$\Phi_{\xi}^{(A)} = -\sum_{j=1}^{M} \xi(j|A) \ln \xi(j|A) \pm \beta_{\xi}^{(A)} \sum_{j=1}^{M} \xi(j|A) G(j|A\ldots) + \gamma_{\xi}^{(A)} \sum_{j=1}^{M} \xi(j|A), \qquad (16)$$

where $\xi(j|A\ldots)$ – function of the distribution of the conditional ratings „in the sight of the subject A" in a group of M subjects. Since we further consider a two-level system, we accept $M = 2$, and j takes the two values: A and B; $G(j|A\ldots)$ – cognitive rating function.

If differential ratings are considered, then functions $\xi(j|A, \sigma_{i1})$ are used.

The analogous functionals are introduced for the second subject B: $\Phi_{\pi}^{(B)}$ and $\Phi_{\xi}^{(B)}$. Independently upon the sign before the second summation member in the functionals of (15) and (16), the „optimal" distribution of $\pi_A(\sigma_{i1})$, as well as the distribution of $\xi(j|A, \sigma_{i1})$ – deliver the maximum to the corresponding functional. The solution of the variational problems with the functionals (15, 16) yields the distributions:

$$\pi_A(\sigma_{i1}) = \frac{\exp\left[\beta_{\pi}^{(A)} F_A(\sigma_{i1})\right]}{\sum_{q=1}^{N_A} \exp\left[\beta_{\pi}^{(A)} F_A(\sigma_{q1})\right]}; \qquad (17)$$

$$\xi(j|A, \sigma_{i1}) = \frac{\exp\left[\beta_{\xi}^{(A)} G(j|A, \sigma_{i1})\right]}{\sum_{\rho=1}^{M} \exp\left[\beta_{\xi}^{(A)} G(\rho|A, \sigma_{i1})\right]}. \qquad (18)$$

We get the analogous distributions for the subject B: $\pi_B(\sigma_{i2})$; $\xi(j|B, \sigma_{i2})$, where j gets the value of A and B.

The general theory acquires some additional details and suppositions. As it is β_{π}^{-1} and β_{ξ}^{-1} are interpreted as psychic (or emotional) temperatures, in particular $\beta_{\xi}^{-1} = \tau_{\xi}$ is the social temperature. We see, that if, for instance, $\beta_{\pi} \to 0$, or $\tau_{\pi} \to \infty$, then the distribution $\pi_A(\sigma_{i1})$ tends to a uniform one, and the related entropy acquires the maximal value $H_{\pi A} = \ln N_A$; vice versa, if $\beta_{\pi} \to \infty$, i.e. $\tau_{\pi} \to 0$, then the distribution $\pi_A(\sigma_{i1})$ becomes the singular, and the entropy turns to be zero.

It is supposed the existence of the entropy thresholds that determine a certain structure of the entropy space. One of the thresholds is connected with a possibility of making a decision (with a problem of choice). As it is, if $H_{\pi A}^{*}$ – threshold of an objects entropy of the bearer A, it is supposed that if $H_{\pi A} > H_{\pi A}^{*}$, then the alternatives are „merely distinguished" by the subject

A and decision (choice) cannot be made. One of the necessary conditions for a decision making is the accomplishment of the condition

$$H_{\pi A} \leq H^{*}_{\pi A}. \tag{19}$$

This is one of the necessary conditions for a choice – decision making at a set of the objects alternatives. For a decision making at the set of S_{ξ}, the necessary condition is $H_{\xi A} \leq H^{*}_{\xi A}$.

There are other, additional conditions, as well as the sufficient conditions.

Connectivity of subjects

When one is talking of a „system", including „hierarchical system", it is deemed that there is certain connectivity amongst the subjects acting at the different levels of the hierarchy, as well as at the same level.

It is distinguished the objective connectivity through the resources of different kinds, connectivity stipulated by the established organizational structure via ranks. The objective connectivity – is the common character of the resources, technologies, methods of resources exchange, established regularities, assignments, laws; the connectivity established by an existing system of ranks.

It pertains to the subjective connectivity the presence of nonempty intersections of the individual „problems" sets $S_{a\xi}$; $\left(j \in \overline{1,M}\right)$, hence, the presence of common problems (goals), the part or complete community of ethics systems – sets of ethical *imperatives*, presence of the informational exchange.

The subjective information contained in the event A for the subject „ j " is determined by the formula

$$I(j|A) = H_j - H_j(A). \tag{20}$$

Then, if the event A is the *position* of the subject i in the group and *cooperation* of the subject j with the subject i

$$I(j|i) = H(j) - H(j|i), \tag{21}$$

where $H(j)$ – entropy of the subject j at the absence of the subject i; $H(j|i)$ – entropy at the presence of i. In an analogous way it is determined the information of

$$I(i|j) = H(i) - H(i|j). \tag{22}$$

Here $H(i)$ and $H(j)$ – entropies of the isolated subjects.

In the general case

$$I(i|j) \neq I(j|i). \tag{23}$$

For a two-level system with the subjects A and B the formulae (21), (22), and (23) are written in the view of:

$$I_A(\ |B) = H(A) - H(A|B), \tag{24}$$

$$I_B(\ |A)=H(B)-H(B|A), \tag{25}$$

$$I_A(\ |B)\neq I_B(\ |A). \tag{26}$$

It is possible to represent the large variety of the types of the connectivity for the sets of S_{aj}. If at least one of the alternatives is contained simultaneously at the all sets of S_{aj}, we will call the system a utilty-connected (fig. 2).

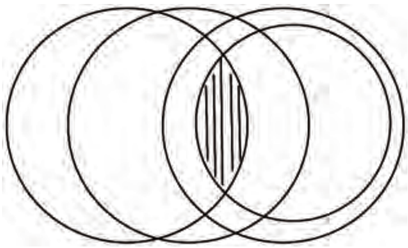


Fig. 2

A system is a linearly-connected one if the sets of S_{aj} have the nonempty intersections in pairs, that is from $S_{ai}\cap S_{aj}=S_{aij}\neq\emptyset$ and $S_{ai}\cap S_{ak}=S_{aik}\neq\emptyset\Rightarrow S_{aij}\cap S_{aik}=\emptyset$ (fig. 3).

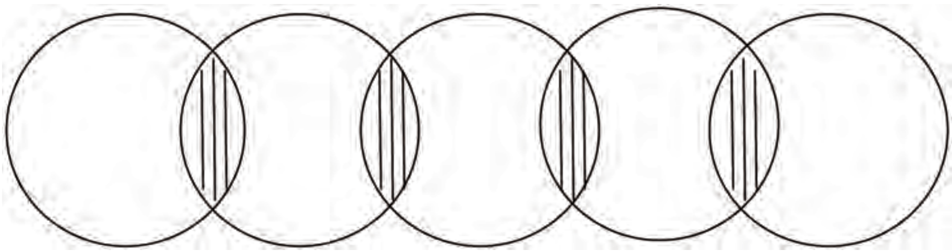


Fig. 3

We will emphasize that the supposition about a degree of the mutual informativity of subjects about the sets of alternatives of other subjects, their apriori distributions of preferences of the I[st] and II[nd] kinds, about their disposal resources is important.

Example

In order to illustrate the above speculations, let us conduct a calculation experiment. We will use, for instance, a problem of flight safety elaborated in subjective analysis [5]. There, there is a scheme of a special situation that may arise in the flight as a result of „closing", on one reason or another, the airport of destination. The three extra aerodromes are the alternatives: σ_1, σ_2, *and* σ_3; *the distance to each of them depends upon the time of the special situation happening* t^*. *A certain risk is connected with the each of the alternatives; and the risk, by an assumption,* *depends upon the place of the airplane at the moment t* determined by the two parameters: R – position radius of the airplane with respect to the center of the circle drawn through the three extra aerodromes; and ϕ – position angle between the airplane position radius and the position radius of the third airport, also with respect to that center of the circle drawn through the three extra aerodromes.*

The concept of SEMP yields preferences functions similar to (17)

$$\pi\left(\sigma_k \middle| R,\phi\right)=\frac{\exp\left[-a_k\left(R,\phi\right)\right]}{\sum_{q=1}^{3}\exp\left[-a_q\left(R,\phi\right)\right]}, \qquad (27)$$

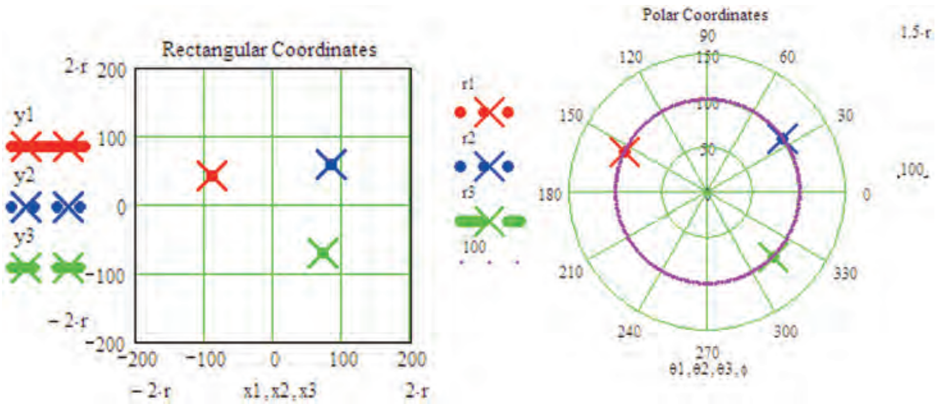
where $a_k(R,\phi)=dL_k(R,\phi)$; d – coefficient that reflects the connection of the „risk" with the distance $L_k(R,\phi)$ to the extra aerodrome. The subjective entropy similar to the first summation member in the functional (15)

$$H_\pi=-\sum_{k=1}^{3}\pi\left(\sigma_k \middle| R,\phi\right)\ln\pi\left(\sigma_k \middle| R,\phi\right). \qquad (28)$$

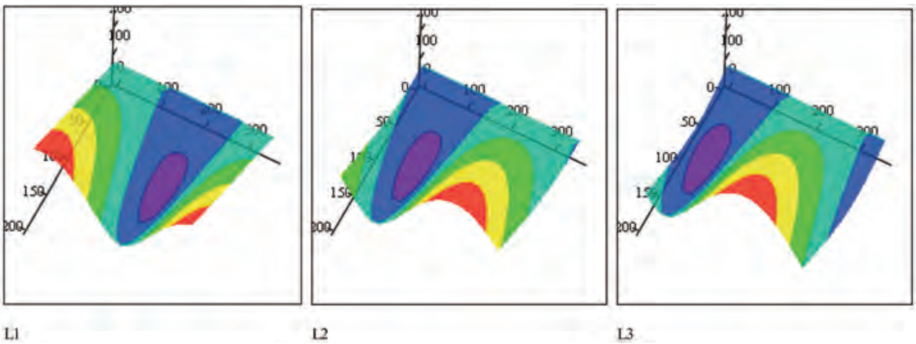
Calculations with the data: r=100 – radius of the circle drawn through the three extra aerodromes, in miles; φ=0….360; φ_0=-45; φ_1= 200; φ_2=80; φ_3= 0; – corresponding angles, in degrees; R=0…200, in miles; d=0,5; performed with the use of (27) and (28) are illustrated in fig. 4.

Analysis of the researches results and discussions

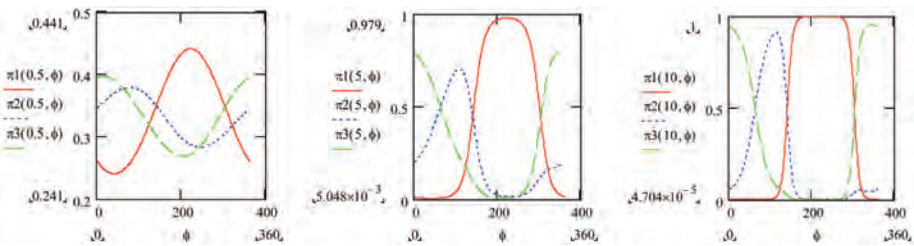
From the diagrams plotted in fig. 4, it is visible that the values distributions depend significantly upon the „geographical" place of the point of the specific situation occurrence. For some certain combinations of the values of R and ϕ the entropy of $H_\pi(R,\phi)$ is high; and that means that the decision making about the variant choice is getting difficult. Apparently, in those cases the additional information will be drawn [5].



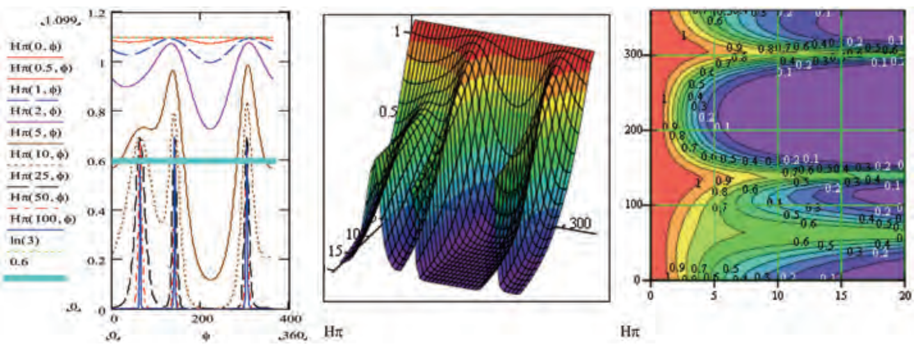
a) Coordinates



b) Distances



c) Preferences



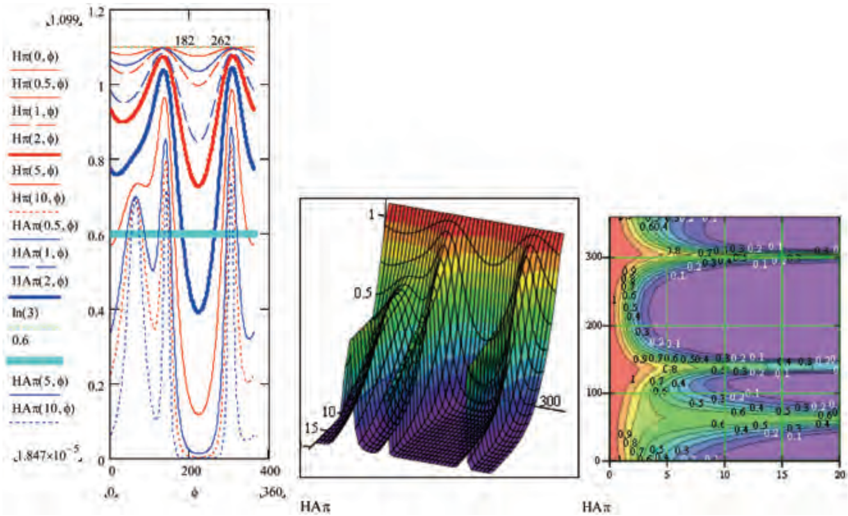
d) Entropies

Fig. 4

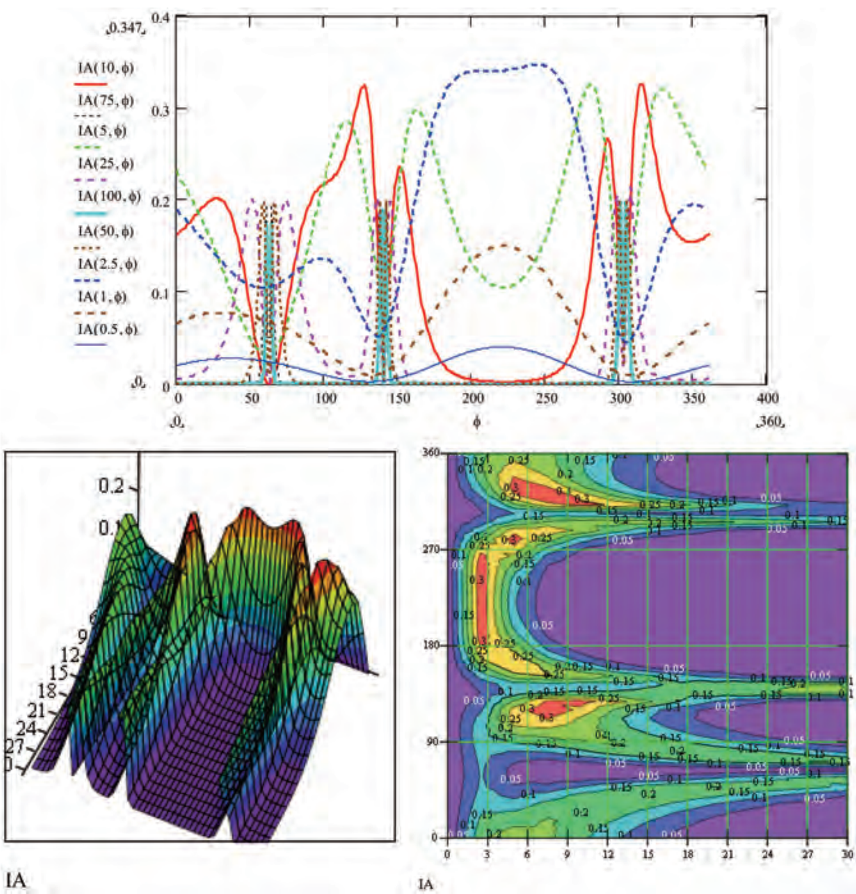
In fig. 4, d) the entropy threshold 0.6 symbolizes the impediment for the decision making at the diapason of $R=0...2$ at any ϕ. Let us make a modeling of the subjective information contained in the event A: the coefficient $d=0.8$. All other parameters remain the same. With the application of the concept (20) we get the results presented in fig. 5.

In fig. 5, a) it noticeable the decrease of the entropy as the result of the event A. The values of the entropy for $R=2$: $HA\pi(2,\phi)$ is lower than the threshold 0.6 in the diapason of $\phi \approx 182...262$.

The subjective information maps (fig. 5, b)) show the expected informative value of the event A depending upon the „geographical" place of the point of the specific situation happening.



a) Entropies



b) Subjective information

Fig. 5

CONCLUSIONS AND FURTHER RESEARCHES PROSPECTS

The next work by the authors is dedicated to the problem of further concretization of the entropy theory of conflicts and solution of the problem of conflicts control.

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PARADYGMAT ENTROPII W TEORII HIERARCHCZNYCH SYSTEMÓW AKTYWNYCH. ELEMENTY TEORII KONFLIKTU

Streszczenie

W publikacji zaproponowano pewien wariant teorii hierarchicznych aktywnych systemów. Wariant ten oparty jest na zasadzie maksymalnej subiektywnej entropii [3, 4], która z punktu formalnie matematycznego, zbiega się z zasadą Jaynes-Gibbsa [1, 2].Wspomniana tu zasada opiera się na pojęciu subiektywnej entropii, na zasadzie „indywidualnym posiadaniu" i schemacie agregacji preferencji; i, w tym sensie, zasady te są niezależne.

Model hierarchii preferencji jest zbudowany na rozkładzie przedmiotów i ocen preferencji. Stosowana jest zasada hierarchicznej addytywności entropii w postaci Shannona.

Teoria konfliktów, konflikty rozkładów preferencji, jest opracowana na podstawie tego modelu. Zaproponowano klasyfikację konfliktów, które w znacznym stopniu odzwierciedlają istniejącą wiedzę w tej dziedzinie. Transformacja konfliktu z jednej fazy do drugiej jest związana z przezwyciężaniem pewnych określonych progów entropii. W pracy zauważono, że dynamika konfliktów zewnętrznych – niepersonalnych zależy od konfliktów personalnych – międzyludzkich.

W przedłożonej teorii, zdaniem autorów, jest aktualnym problem wpływ na badania bezpieczeństwa aktywnych systemów oraz problemów bezpieczeństwa lotu od systemu transportu lotniczego, jako całość, oraz systemu „samolot-Pilot-środowisko", w szczególności. Formalizacja opracowana w pracy jest skutecznym środkiem do rozwiązania problemów, w których system aktywny znajduje się w sytuacji wyboru decyzji z pewnego zbioru alternatyw. Jeśli przyjrzymy się bliżej, okaże się że ma to miejsce praktycznie w każdym wypadku lotniczym lub w innym konflikcie.

Postaramy się wyjaśnić termin „system aktywny" w oparciu o [6, 7, 8, 9, 10, 11, 12, 13, 14, 17, 18] w kolejnych pracach. Tutaj przytoczymy tylko terminy odnoszące się do pracy filozofa Berdiayev N. A. [15] „Źródło i sens rosyjskiego komunizmu": „Źródło ruchu jest w środku, a nie na zewnątrz, nie pochodzi z kosmosu, jak myśl, przez materializm mechaniczny, prawdziwa wolność jest nierozerwalnie związana z materią, jest źródłem aktywności w tej sprawie z wnętrza zmienia środowisko".

Ten punkt widzenia jest jednolity z twórcą myśli. Zadanie w danym przypadku jest takie, aby interpretować je w warunkach paradygmatu entropii, czyli subiektywnej entropii.