Modeling Systems’ Interactions Type “Stochastic - Determined”

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***Abstract* —** publications **a**nalysis revealed some disadvantages in enterprises’ interactions modeling. The article is “filling the gap” in modeling of inter-system interaction type “stochastic – determined” by using earlier devised enterprise math model. Main features of catastrophe theory were compared with developed protection theory. Previously unknown dependence of the kinetic energy on the substance viscosity in any of the environment, where force majeure exists, is given. Previously unknown fundamental relationships between the turbulence propensities of this substance and the probability density of the force majeure kinetic energy on these substances’ viscosity. Enterprise resource damage calculation was given; math model of rivalry in commodity market and pertinent indicators of enterprise activity were showed.

***Keywords* —** enterprise model, systems’ interactions, rivalry, force-majeure, control.

I. INTRODUCTION

A SET of functions and a set of processes represent the human environment. The uninhabited environment is characterized by any functions absence and is specified by the interactions of natural turbulent processes in the atmosphere, turbulent and laminar processes in rivers or oceans, and laminar processes in the Earth’s solid. The interactions of these processes are the source of force-majeure (FM) - hurricanes [1], tsunami, etc. At the same time, FM math models are empirical and therefore inaccurately predictable.

From system analysis point of view natural processes in any biome are considered as stochastic systems [2], and any FM influences on any enterprise are considered as inter-system interactions of the stochastic-determined type. The random FM influences on any enterprise are changing its complementary resource [3] and its state (Fig. 1). In turn, the set of an urbanized environment functions, as a rule, negatively influence on natural processes. We consider such influences as inter-system interactions of the determined-stochastic type. They are characterized by such indicators as, for example, drainage of wetlands, deforestation, pollution of the atmosphere by aerosols, pollution of the territory with radio-nuclides, flooding of rivers’ coastal areas during hydraulic structures construction, etc.

Named and other influences in the human environment are identified and are normalized to reduce their negative effects and reduce the corresponding risks for both parties. Some values of influences were established, for example, maximum permissible concentrations. Many methods were created, such as ISO 9001 [4], ISO 14000 [5], ISO 27013 [6], 6σ [7], Balanced Scorecard [8] and others aiming to improve enterprise functions, to prevent defects in its products p and to reduce the negative influences on natural processes.

The analysis of publications on our article topic revealed two features of any enterprise interactions modeling. On one hand, the practical tasks solution of any enterprise management and the profile specialists preparation [9] are carried out on an enterprise model that does not include the external environment, despite the fact this environment contains some resources suppliers (for example, power, human), its products consumers and sources of negative influences, including FM. On the other hand, such modeling tools as game theory [10], scheduling theory [11] and queuing theory [12] consider by default an enterprise and its interactions in any market in the “dietary” form, or, in other words, when the external environment has zero influences on participants’ resources. As of today, the primary reason for this feature of models is the lack of enterprises’ activity formalization, which adequate to its real activity.

II. DISCUSS PROBLEM

The catastrophes theory (CT) [13] and the developed protection theory (PT) differently describe the trajectory of any enterprise state S from some zero point in time and after the moment $vol_{1\ infl}$ of influence on it (Fig.1). Thus, due to the lack of quantitative descriptions of enterprise activity, the CT “plunges” it into a catastrophe state S_{cat} under the only external smooth influence applied to an unknown point of enterprise at this moment. In turn, PT ascertains the bifurcation of its state S_{prot} at this moment.

CT is based on the process approach, covers the enterprise as a whole and, in particular, cannot quantitatively fill the term “catastrophe” due to the lack of analytical expressions for quantitative description the enterprise internal and external processes and points of influence application. Unlike the catastrophes theory, PT is based on functional and process approaches, so that it is able to describe a broader “list” of enterprise interactions and activity appraisals than CT.

Based on PT, the enterprise control system combines the

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functions of managing production processes and the functions of protecting its resources. This feature significantly distinguishes it from the known systems.

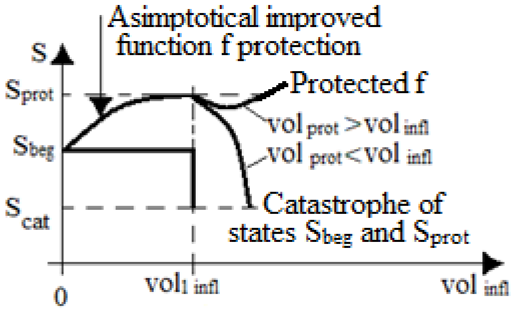

Fig. 1. CT (beneath) and PT essences illustration; f designate enterprise function; S_{beg} – enterprise initial state S; S_{cat} and S_{prot} – catastrophic and protected states, which enterprise obtains under influence amount $vol_{1\ infl}$; vol_{infl} represents scale of influence volume.

Along with this, PT needs to resolve such problems as substantiating the end-to-end all internal processes discretization (sampling) from the top to the bottom level of control, selecting some universal physical parameter for description natural processes' influences on enterprise activity, creating a math model of FM influence on enterprises, etc. The article proposed one of the solutions to the last problem.

III. SOLUTION OF THE PROBLEM

A. Description of the Developed Approach

Everything in nature is interconnected. Our goal is to find the quantitative characteristics of "multy-faces" FM that act on enterprise resources. As showed beneath this way we can describe quantitatively any FM effects on enterprise routine.

CT considers either any enterprise interaction with other enterprises (the type of inter-system interaction "determined-determined"), or interactions with natural processes (the type of inter-system interaction "stochastic-determined"). The PT based on enterprise control concept, which combines the enterprise control function and the protection its resources function in one protected software and hardware complex. This way any enterprise control system obtains a new characteristic - measuring device characteristic.

PT uses classical deductive system function. We change it by introducing three significant novelties. Firstly, we assume every enterprise function f has a set of seven complementary resource components: r_{env} (environment), r_{te} (technical), r_{com} (communicative), r_{hu} (human), r_{mo} (money), r_{ti} (time), r_{pr} (protection); herewith some of these components are immanent (for example enterprise territory) and some are taken from environment (for example human resource). Secondly, we assume every resource component has such unique parameters as informational manifestation K_{inf} , perviousness PN (or sustainability) of negative influences on this components. Thirdly, every resource component has unique importance or weight w for every enterprise executable function. In other words, parameter w characterizes every function's sensitivity relatively resource component's changes. Taking this we mathematically describe any enterprise everyday activity as determined system:

$$f(s)=\frac{1}{\begin{bmatrix} w_{env}(1-K_{inf\ env})(1-PN_{env})\ E_{secu\ env}\ E_{count\ env} \\ w_{te}\ (1-K_{inf\ te})\ (1-PN_{te})\ E_{secu\ te}\ E_{count\ te} \\ w_{com}(1-K_{inf\ com})(1-PN_{com})E_{secu\ com}\ E_{count\ com} \\ w_{hu}\ (1-K_{inf\ hu})\ (1-PN_{hu})\ E_{secu\ hu}\ E_{count\ hu} \\ w_{mo}\ (1-K_{inf\ mo})\ (1-PN_{mo})\ E_{secu\ mo}\ E_{count\ mo} \\ w_{ti}\ (1-K_{inf\ ti})\ (1-PN_{ti})\ E_{secu\ ti}\ E_{count\ ti} \\ w_{pr}\ (1-K_{inf\ pr})\ (1-PN_{pr})\ E_{secu\ pr}\ E_{count\ pr} \end{bmatrix}} X$$

$$X \frac{p_0\ s^0 + p_1\ s^1 + \ldots + p_n\ s^n}{\begin{bmatrix} r_{env\ 0}\ s^0 \\ r_{te\ 0}\ s^0 \\ r_{com\ 0}\ s^0 \\ r_{hu\ 0}\ s^0 \\ r_{mo\ 0}\ s^0 \\ r_{ti\ 0}\ s^0 \\ r_{pr\ 0}\ s^0 \end{bmatrix} + \begin{bmatrix} r_{env\ 1}\ s^1 \\ r_{te\ 1}\ s^1 \\ r_{com\ 1}\ s^1 \\ r_{hu\ 1}\ s^1 \\ r_{mo\ 1}\ s^1 \\ r_{ti\ 1}\ s^1 \\ r_{pr1}\ s^1 \end{bmatrix} + \ldots + \begin{bmatrix} r_{env\ n}\ s^n \\ r_{te\ n}\ s^n \\ r_{com\ n}\ s^n \\ r_{hu\ n}\ s^n \\ r_{mo\ n}\ s^n \\ r_{ti\ n}\ s^n \\ r_{pr\ n}\ s^n \end{bmatrix}} + \varphi(s) \qquad (3.1)$$

where w_{env}, w_{te}, w_{com}, w_{hu}, w_{mo}, w_{ti}, w_{pr} represent weight (w) or importance of every named above complementary resource components of executable f(s) (look at these components' behavior on Fig.2); indicator K_{inf} represents named above resource components' informational manifestation; indicator PN represents "**P**erviousNess" negative influence on pertinent resource component; E_{secu} and E_{count} represent efficiency of enterprise security system and its counteract system respectively concerning pertinent resource component; column-matrix of coefficients w, $(1-K_{inf})$, (1-PN), E_{secu} and E_{count} is column-matrix of complementary coefficients; p_i is amount of production p which enterprise produces in i-th moment (i = 0, 1 … n) of astronomical or local (system) time; s is argument of Laplace-transform; r_i is sample amount of named above resource component which is used to produce production p_i; φ(s) represents enterprise activity initial conditions.

PT "knows" all enterprise's functions f and the complementary resources [r] belonging to every of these functions, owing to multi-level decomposition [3] (no one has yet canceled the hierarchical principle of enterprise control). It is clear that all resources' state in the model (3.1) is managed by enterprise control system and that resources are points of influences' application, in particular, FM on an enterprise.

We note, along with the existence of the research methodology, different approaches and methods for resolving the problems of enterprise's activity modeling, it was inappropriate to use models described in the publication [9] in our work, because their characteristics are too distant from model (3.1).

Let us show the consistent application of model (3.1) for modeling any FM influence on enterprise activity, i.e. for modeling the inter-system interaction type "stochastic - determined".

B. The Resulting Quantitative Ratios

Initially, we tested model (3.1) on inter-system interactions of the determined-determined type using the example of a successful elementary commodity market [3]. There are one manufacturer (Enterprise 1) and one consumer (Enterprise 2) in the market; both participants operate in relation to one product name. Model (3.2) represents this market

$$p_1(s)/MC_1=p_2(s)/MC_2 \qquad (3.2)$$

or in terms of enterprise's functions and resources we have identical form

$$[f_1(s)r_1(s)]/MC_1 = [f_2(s)r_2(s)]/MC_2, \qquad (3.3)$$

where $f_1(s)$ and $[r_1(s)]$ are the function and complementary resource of Enterprise 1; $f_2(s)$ and $[r_2(s)]$ - the function and complementary resource of Enterprise 2; MC_1 and MC_2 - the manufacturing cycle (MC) of Enterprise 1 and Enterprise 2 respectively.

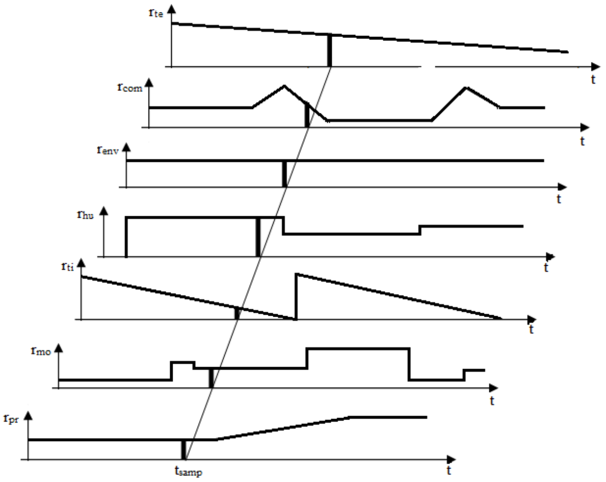

Fig. 2. Behavior of complementary resources in time t; t_{samp} designates moment of these resources sampling.

The interpretation of expressions (3.2) and (3.3) is as follows: nothing prevents Enterprise 1 and Enterprise 2 to keep the same activity dynamics. Similar interpretation is valid for larger sizes successful markets.

PT has quantitatively filled such a multi-parameter characteristic of interactions in different sizes markets [14] as rivalry and verbally determined "perfect competition" [15]. Bidirectional vectors in vector math model of rivalry (Fig.3) represent this characteristic of commodity producers and commodity consumers including trade.

In case of elementary successful market (Table 1) there is no rivalry. In case of a simple market, a necessary condition for rivalry appearance is the entry a new participant into this market. Sufficient condition for the rivalry appearance in the market is the popularity of several consumers' activities dynamics for other market participants. Equality (3.4) represents the condition for the success of larger sizes markets

$$P_{prod.mid}/MC_{prod.mid} = p_{cons.mid}/MC_{cons.mid} \qquad (3.4)$$

So the number of market participants should be determined. In addition to rivalry, PT made it possible to find quantitative parameters of interaction in different sizes markets: the condition of recession, the lost profit volume, the volume of downtime.

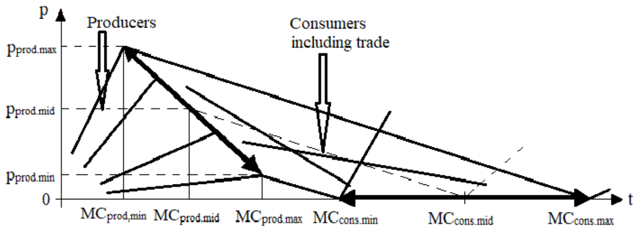

Fig.3. Rivalry vector math model between commodity "Producers" and between commodity "Consumers, including trade" in complex market; $p_{prod.max}$, $p_{prod.mid}$, $p_{prod.min}$ - maximum, mid, minimum commodity quantity p Producer brought on the market respectively; $MC_{prod.min}$, $MC_{prod.mid}$, $MC_{prod.max}$ - minimum, mid, maximum amount respectively of Producers' manufacturing cycle; $MC_{cons.min}$, $MC_{cons.mid}$, $MC_{cons.max}$ - minimum, mid, maximum Consumers' MC respectively.

Table 1. Commodity market math models

Elementary: $P_{prod.}/n\Delta t = P_{cons.}/n\Delta t$, where commodity is single, producer is single, consumer is single.
Simple: $P_{prod.}/ n\Delta t = 1/I \sum_{i=2}^{I} P_{cons.i}/(n\Delta t)_I$, where commodity is single, producer is single, consumer is i, i ϵ [2; I]. If "I" equal all consumers' quantity, the market is monopolistic.
International monopolistic: $P_{prod.}/n\Delta t = 1/I \sum_{j=2}^{J} \sum_{i=2}^{I} P_{cons.i}/(n\Delta t)_i$ where commodity is single, producer is single, consumer is i, i ϵ [2; I], I is all consumers' quantity in country, quantity of countries is j; j ϵ [2; J].
Complex : $\sum_{z=2}^{Z} P_{prod.z}/(n\Delta t)_z = 1/I \sum_{i=2}^{I} P_{cons.i}/(n\Delta t)_i$ where commodity is single, producer is z, z ϵ [2; Z], consumer is i, i ϵ [2; I].
Real : $\sum_{m=2}^{M} \sum_{z=2}^{Z} P_{prod.z}/(n\Delta t)_z=1/I \sum_{i=2}^{I} P_{cons.i}/(n\Delta t)_i$ where commodity is m, m ϵ [2; M], producer is z, z ϵ [2; Z], consumer is i, i ϵ [2; I]

We found, for the elementary market, the recession starts at $MC_2 = 1.5MC_1$, for larger sizes markets - at $MC_{prod.mid}=1.5MC_{cons.mid}$ (Fig.3). In addition, model (3.1) turned out to be invariant when applied to a trial high-level control system of a region. At the same time, we note that any enterprise becomes a stochastic system if its activity dynamic becomes negative. We guess that PT will help us fill quantitatively the term "catastrophe".

Suppose, there is a subject of negative influence (SI), as a rule, with the participation of a person, having $f_{SI}(s)$ and $r_{SI}(s)$ in the same elementary successful market. This SI aims to deliberately damage Δr_2 the resource $[r_2(s)]$ of Enterprises 2, i.e. $f_{SI}(s)r_{SI}(s) = -\Delta r_2$. A quantitative description of this interaction in terms of model (3.1) with $MC_1 = MC_2$ gives expression (3.5)

$$f_1(s)[r_1(s)] > f_2(s)[w_2(1-K_{2inf})(1-PN_2)E_{2sec}E_{2count}][r_2(s)]\{1-[f_{SI}(s)r_{SI}(s)]/[r_2(s)]\}, \qquad (3.5)$$

where the bracket $\{1-[f_{SI}(s)r_{SI}(s)]/r_2(s)\}$ characterizes bifurcation (Fig.1) in the behavior of Enterprise 2 main indicator $p_2(s)$, i.e.

recession $p_2(s)$, if $[r_{SI}(s)]/[r_2(s)] \geq 1$,
allowed deviation $p_2(s)$, if $[r_{SI}(s)]/[r_2(s)] < 1$;

herewith the scalar $[1 - w_2(1-K_{2inf})(1-PN_2)E_{2sec}E_{2count}] \equiv [1 - w_2(1-K_{2inf})(1-PN_2)E_{2prot}]$ characterizes quantitatively the Enterprise 2 risk in the considered size market

$$\text{risk } p_2(s) = 1 - w_2(1 - K_{2inf})E_{2sec}(1 - PN_2)E_{2count} \qquad (3.6)$$

Obviously, in case of Enterprise 1 recession in this market, i.e. at $MC_1/MC_2 > 1$, the SI negative influence on Enterprise 2 refine the market situation. It means the market becomes more successful

$$f_1(s)[r_1(s)] \sim f_2(s)[w_2(1 - K_{2inf})(1 - PN_2)E_{2sec}E_{2count}][r_2(s)]\{1-[f_{SI}(s)r_{SI}(s)]/r_2(s)\} \qquad (3.7)$$

Reverse situation takes place, when Enterprise 2 has recession, i.e. $MC_1 < MC_2$. In this case SI negative influence on Enterprise 2, on the contrary, deteriorates the situation in this market

$$f_1(s)[r_1(s)] >> f_2(s)[w_2(1 - K_{2inf})(1 - PN_2)E_{2sec}E_{2count}][r_2(s)]\{1-[f_{SI}(s)r_{SI}(s)]/r_2(s)\}. \qquad (3.8)$$

Following judgments above, we move from the model (3.3) of the SI deliberated influence on the market participant to the model of FM unintended, aimless, influence on enterprise. To do this, using the terms of the model (3.1), we will collect some FM complementary resources in their decomposition in Table 2.

Table 2. Resources of some FM

Resource	Earthquake	Tsunami	Meteor fall
r_{te}	Earth solid's E_{kin}	Water's E_{kin}	Meteor's E_{kin}
r_{env}	Earth solid	Water	Earth solid & Atmosphere
r_{com}	Earth solid	Water	Earth solid & Atmosphere
r_{hu}	0	0	0
r_{mo}	0	0	0
r_{ti}	Few sec.	Few hours	Parts of sec.
r_{pr}	0	0	0

Matching of these FM shows: the FM resource r_{te} for market participant's damage is the kinetic energy E_{kin} of the environment r_{env}, where FM exists. At the same time, the substance viscosity define the FM spread in this r_{env} and carry out through its "communicative resource" r_{com} with its ability to spread this FM kinetic energy.

Every FM purposeless means neither FM functions nor influence processes could be form; otherwise, an influence instrument will be create as a result. This statement made it possible to replace the functional $[f_{SI}(s)r_{SI}(s)]/r_2(s)$ in expression (3.3) with the μ_{FM} variant, which modifies expression (3.5) to the form

$$f_1(s)[r_1(s)]>f_2(s)[w_2(1-K_{2inf})(1-PN_2)E_{2sec}E_{2count}]x$$
$$x[r_2(s)](1 - \mu_{FM}), \qquad (3.9)$$

where a negative amount of the bracket $(1 - \mu_{FM})$ corresponds to the Enterprise 2 damage, and this bracket positive amount - to the damage absence; $\mu_{FM} \in [0; Max]$, where $\mu_{FM} = 0$, if $r_{FM}(s) = 0$, and $\mu_{FM} = Max$ means the maximum volume of FM scale - Earthquake [16], hurricane [17], etc. Let us explain. In case of the seismic stability $r_{pr}(s)$ of Enterprise 2 building in 4 points (this is the volume vol_{prot} in Fig. 1) and seismic impact of $r_{FM}(s)$ in 6 points (the volume vol_{infl} in Fig. 1) we have $(1 - \mu_{FM} = - 0.5)$. It means damage presents (FM energy dissipation during influence is causing damage). Another example: if $r_{pr}(s)$ is resistant to tsunami equal to 5meters height and the tsunami wave height $r_{FM}(s)$ is 2meters, we have $(1 - \mu_{FM} = 0.6)$, i.e. there is no damage (this is an energetically unfavorable process).

In other words, the parenthesis $(1 - \mu_{FM})$ characterizes the energy efficiency of FM influence on $r_2(s)$; this efficiency reduction is the purpose of the Enterprise 2 protection resource $r_{pr}(s)$. The parameter PN in the model (3.1) (the ability of any resource to perceive a negative influence on it or simply: the susceptibility of a negative influence) is a means of reducing this FM efficiency, i.e. the energy unprofitable process formation.

Some quantitative examples of any enterprise resources' indicator PN. The r_{mo} has PN ~ 0 due to high security of bills; r_{env} (respiratory mixture at workplace) has PN = 1 due to the high mixing of air with the harm; r_{hu} has PN = 0,02, because of small staff's possibility to be recruited by SI; software r_{com} of the enterprise control system has PN = 0 due to the reliable antivirus. Practical example: to reduce the seismic impact on enterprise building, it is necessary to install a "shock absorber" (PN ~ 1) between the soil and building's basement.

Further, let us express the substance mass m of the environment, where FM exists, through the dynamic viscosity ν of this substance $\nu = c\ vol/m(V_M - b)$, where c and b are constants; vol is the amount of the substance; m is the mass of this substance; V_M is the amount of the substance in moles. Substituting the resulting expression for "m" into an expression for E_{kin} of FM and after transformation we have

$$E_{kin}(\nu)= mv^2/2 = c\ v^2\ [vol / (V_M-b)\ 2\nu]. \qquad (3.10)$$

Expression (3.10) illustrates the previously unknown hyperbolic dependence of the E_{kin} on the substance viscosity ν in any of the $r_{env}(s)$ environment, where FM exists (Fig.3).

Now let us determine the dependence of the "mechanism" of FM energy generation/dissipation, i.e. the turbulence propensity of an environment substance, where FM exists, on the substance viscosity. Using the expression (3.10), we find this dependence as the velocity dEkin/dt = Turb(ν) under an external force [2] in environment r_{env} . After transformations we have

$$\mathrm{Turb}(\nu) = dE_{kin}/dt = c[vol/(V_M – b)](v/\nu)dv/dt, \qquad (3.11)$$

The expressions (3.10) and (3.11) reveal previously unknown fundamental relationships between the Turb(ν) of the substance, where FM exists, the viscosity ν of this substance and the probability density P_{FM} of the FM energy E_{kin} in this substance. The P_{FM} dispersion decreases with the ν growth of this substance (Fig.3) due to the decrease in the number of high-frequency components in the turbulence spectrum.

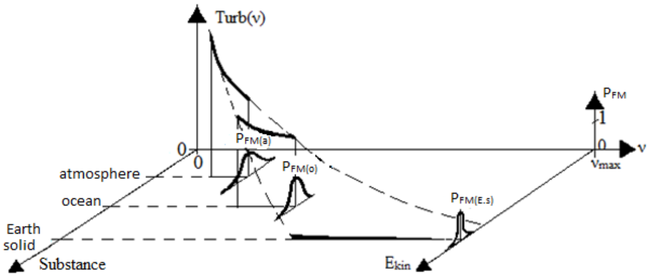

Fig. 3. Fundamental relationship between viscosity ν, the turbulence propensity Turb(ν) of atmosphere (a) ocean (o) and Earth solid (E.s.) substances and the corresponding densities for the probability of $P_{FM(a)}$, $P_{FM(o)}$, $P_{FM(E.s.)}$ of FM energy.

The disadvantage of both the above quantitative relations and the differential equations apparatus for describing the state of the enterprise as system [18] is that they do not reflect the existence of probabilistic or statistical relationships between any enterprise' resource components. These relationships appear the only after the moment of influence by the vol_{1infl} (Fig.1) and create branching processes [19].

C. Founded Above Expressions Usage

Mechanics of destruction [20] reliably models the defect development in a homogeneous part under study. In contrast, PT requires knowledge about named above statistical relationships between these components to model the process of these components damage development and to estimate its amount. It seems these relationships should reflect a rectangular "matrix of statistical relationship between resources", the protected enterprise "design" and the features of the FM determine this matrix unique content.

We clarify it. Our practice [3] of damage $–\Delta r_2(s)$ calculation under FM influence "Earthquake" by calculating the 2-nd mixed central moment of a set of two independent normal random processes [21] - human resource r_{hu} and r_{FM} - showed the limit of theory probability – for random processes the only.

Using founded above expressions we give an example of calculating FM influence on enterprise. Based on (3.10), the amount A_{FM} of FM operation is quantitatively equal to the decrease ΔE_{kin}

$$A_{FM} = \Delta E_{kin} = F_{FM}\,\Delta S, \qquad (3.12)$$

where ΔS denotes the distance that any point of building's wall moves under F_{FM} action; this movement is possible with the destruction of the wall. Consequently, the condition for building's wall destruction is inequality

$$F_{FM} / \mathrm{square}_{wall} > \sigma_{wall} , \qquad (3.13)$$

where square_{wall} is this wall area which is affected by FM; σ_{wall} - compressive strength of the wall substance (brick, super concrete, others).

The PT uses the σ_{wall} as a quantitative value of the wall substance threshold val $_{prot}$ (see Fig.1) If F_{FM} overloads the threshold val $_{prot}$, the consequence is damage. For our calculation, it means that the σ_{wall} characterizes the minimum value of the F_{FMmin} force, which presses on the elementary square wall ($\mathrm{e.s.u.}_{wall}$) (elementary square unit) and yet does not destroy the wall

$$\sigma_{wall} = F_{\Phi MOmin}/\mathrm{e.s.u.}_{wall} , \qquad (3.14)$$

where the area of the square_{wall} is known by measurements. Taking into account the latter, for the case of the wall destruction, the expression (3.13) takes the form of inequality

$$F_{FM} > \sigma_{wall} \times \mathrm{square}_{wal} . \qquad (3.15)$$

In view of (3.10), expression (3.15) will take the form

$$\Delta\{cv^2\,[vol / (V_M – b)2\nu]\} > \sigma_{wall} \times \mathrm{square}_{wall}\,\Delta S \qquad (3.16)$$

Expression (3.16) shows A_{FM} decreases with increasing viscosity ν of the substance, where FM exists and spreads. This condition occurs in real life.

IV. Conclusion

Proposed math model of force majeure influence on enterprises' activity (math model of inter-system interactions of the stochastic-determined type) based on the previously developed enterprise math model. Unresolved problems of the developed protection theory named. The previously unknown fundamental relationships between the turbulence propensity of atmosphere's, ocean's and Earth solid's substance, where force majeure exists, and the probability density of the FM kinetic energy on the viscosity of this substance, were found. Vector math model of rivalry in different sizes commodity markets and some these markets' indicators were given; quantitative expressions for any enterprise resources damage calculation were found.

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