

Application of general concepts and methods of theory of self-organization to the questions of motion and transformation of energy in nature

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General concepts of theory of self-organization can be applied to practical tasks of creation of new energy sources. That can be done using similarities observed in real processes of motion of energy in nature and in typical engineering systems of self-organization. Theoretical approach for this includes generalization of methods for control of self-organization. The approach also includes application of such concepts from computer science as distributed memory. Both these sides of the approach can lead to more definite and detailed understanding of such astrophysical processes as formation, existence and disappearance of stars, regarded as examples of energy sources on appropriate spatial scales.

PACS numbers: 01.30.Cc; 05.45.Df, 05.45.Pq, 05.65.+b

Keywords: self-organization, cellular space, energy sources

1. Introduction

Typical process of self-organization in some open system assumes formation of self-organized structures appeared in motion of energy between input and output of the open system. The structures are formed in dynamics of internal interactions in the system, which has no informational inputs and outputs to outer world. Such an approach has its advantage in regard to the task of detailed analysis of internal dynamics of the system. It also allows illustration of some basic positions of the idea about making of new energy sources on the basis of general similarities with processes of self-organization. These similarities can be understood using quiet simply note about direct link between structures of self-organization on some scale with other energy conducting structures on another scale.

Let us take as example classical system of self-organization - Benard cells [1]. These self-organized structures appears on relative macro scale. Energy from input to the system was consumed on its relative micro scale of internal atomic and molecular vibrations of liquid. Then part of this energy is transferred to energy of motion of structures on macro scale in the same

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liquid.

That is simply the basic way to obtain energy in energy source on macro scale.

Basically, the problem to make it is mainly a problem to organize such conditions as are organized in most systems of self-organization, where part of energy of motion on micro scale is transferred to energy of motion of some structures on macro scale.

This transfer, if one will investigate it deeper, can go via observable energy conducting fractal-like spatial structures and via some directly not observable structures. If one will consider formation of some observed in nature fractal-like structures [2] having no visible spatial or dynamical structures like waves to be interpreted as intermediate carriers for energy transfer between the scales, one has to make some hypotheses about the carriers. Such a hypothesis with some additional assumptions leading to correspondent conclusions how to build new energy sources is presented in the main part of the paper.

2. Multilevel logic division in space as basis for its structuring

If one will consider means for direct computer simulations of real physical space using simplest mathematical constructs, one can take as example model, developed by author of [3]. This model is characterized by finite set of elements of cellular space. The element is counter by module, which counts up to some chosen maximum number. Then counter resets and count begins again. Relative speed of the count is influenced by link coefficients connecting a single counter with neighbors. This can be presented by accepted in cellular automata [4] notation:

$$X_i^t = F(X_i^{t-1}, \{X_q^{t-1}\}) \quad (1)$$

where X_i^t – is a value of certain parameter of the cell with number i on the time step t having a $\{q\}$ set of neighbors.

Such a parameter in the model [3] is a number at a counter to be increased or decreased.

For efficiency in calculations, number of the neighbors is not taken too big. Instead of taking it to a number of all the other elements of space, author of [3] postulates existence of hidden mechanism to preserve synchronization of all the counters in the space. By our opinion, mention of this hidden mechanism is advantage of the model in comparison to the other cellular models [4], which do not reflect in equation (1) action of mechanism preserving all the cellular space in unity and link.

To reflect action of this mechanism, one has to note that the $\{q\}$ set of neighbors in formula (1) has to be equal to the number of all the spatial elements $N - 1$.

Acceptance of this fact leads to some general conclusions about nature of any structure appeared in the space. Link of every spatial element with all the others via function F may mean presence of a scale of characteristic interaction speeds or scale of efficiencies of transfers between the elements. This scale may be correspondent to some kind of periodicity of function F . Taking to account amounts of elementary values transferable on different distances determined by periodicity of function F , one can calculate relative speeds and efficiencies of interactions between the elements on different distances. These speeds of transfers come out from the periodicity and from the transfer efficiencies and shouldn't be mixed with the infinite speed of interaction determined by definition by the form of function F , which links every element with all the others at every moment of time.

The other important note in such a space concerns with concepts of spatial dimensions as yielded from logics of mutual interactions between individual motions of carriers of changes.

These mutual interactions may form special dimensional logics of "non-interacting" motions of some relatively steady structures of condition differences of closely spaced elements. Generalization of properties of this motion on our macro scale logical level gave to us concept of spatial dimensions. This concept generally is not applicable for the space which has possibility for motion between any of its elements. Our dimensions appear as consequence of logic of mutual interaction of carriers of changes. Motion of these carriers creates structures of differences between the spatial elements and influences on form of their dynamics.

These relatively steady structures of differences in conditions of closely spaced elements in model [3] are the differences of phases between neighboring counters by module. As it was shown in [3], the steady structures of phase differences can exist in the form of constantly moving spiral-like kernels. The kernels were set into correspondence to basic elementary particles, their dynamics was studied [3].

However, due to the constraint of model [3] linked with the short neighborhood of interacting counters, there is no assumption about formation of such structures on some other scales in the space. Consequently, another one flaw of the model [3] is linked with absence of any assumption on possibilities and forms of transfers between structures on different scales.

However, assumption of existence of such transfers is a key assumption for building of new energy sources discussed in this paper. It evidently must exist in a space with overall interaction between its elements governed by periodic form of function F .

3. Mechanism of memory functioning in a space

The spatial division yielded from a scale of characteristic speeds and efficiencies of interactions due to a periodicity of function F makes evident general mechanism of interaction between the logical and spatial levels of structuring correspondent to the speed scale. This mechanism is correspondent to universal algorithm of creation, existence and decay observed on fate of every thing. The algorithm is working so due to the general property of interactions in the space with a scale of characteristic speeds of interactions. One has to conclude, that amount of motion correspondent to fastest interaction speed has to be superior in such a space. Due to internal constraints in this motion, it forms basic structures, which can be regarded as primary atoms in philosophic sense. The very existence of these atoms can be regarded as existence of primary bits in dynamic memory. These steady and slow bits appear analogously to standing waves in fastest motion constrained by itself in the space. This motion is analogous to currents in circuits of dynamical memory in computers [5]. Ones take out energy and information of some bit and bring it back to regenerate it. So roles of this motion are distribution and gathering of information about the bits in a scale of the whole bounded space. This has to be done using the fastest characteristic speed in the space.

This motion also has to take part in dynamics of other structures formed on other spatial and logical levels with partial help of correspondent to these levels interaction speeds. This participation may be correspondent to all the three parts of the universal algorithm concerning fate of every thing.

The first one part of this algorithm is to gather slow objects or parts on some slower level to a joined structure. The second part is to support this joined structure in its dynamics in a constant interaction with it (the structure receives also destructive external perturbations and influences from the level of its existence). The third part is to abandon the structure or

break it apart via special ending influence on supported links and associative relationships. The structure ends its existence in both cases. However, the first one case should be considered as natural one. The second case means interrogation to supporting action from faster level in nearest neighborhood. This interrogation has to be from even faster level and its quality has to be higher than main supporting action.

The destructive effect also can be achieved using "horizontal" interactions on the logical level where this structure has been gathered and existed. In such a case, conservative support from the motion with higher characteristic speeds fails and its energy may be consumed by other structures in neighborhood. That is the main way to obtain life energy for different organisms in nature.

However, due to the hypothesized motion with different characteristic speeds, which is responsible by this hypothesis for formation of some natural fractals, there is another way to obtain energy. This way is in possibility to interfere onto this motion of faster logical levels, which forms, supports or destroys some structures on slower levels. This interference becomes possible due to a hypothetic possibility to build conditions for intermediate reflection of this motion on the level, where somebody wants to obtain energy.

This reflection may occur due to the fractal properties of motion via the scales coming to interaction with fractal-like structures on these scales. That looks applicable even relatively to motion out and back from the planets and stars, as they like any object in the space have to be supported by the motion described above.

Partial support for this idea comes from theory of scale relativity [6], which introduces fractality as basic property of space-time. Due to this property it becomes non-differentiable. However, accordingly to the theory, matter itself follows in its structuring and distribution some kind of periodicity, which may be set into correspondence with the form of periodicity to be present in function F . The theory has received direct support in calculations of orbital parameters inside the solar system and in calculations of parameters of general gravitational structuring and mass distribution outside the solar system.

Yet the theory [6] doesn't consider motion by closed trajectories in finite space. Consequently, questions of energy transfers between scales with some fractal forms of geodesic motion of particles were not studied.

To search this transfer in more practical plane one should consider use for this of self-organized structures in the systems of self-organization.

If these structures will be part of some fractal structure with energy transfer passing inside it, disturbance of these structures by some mean will release on this mean part of the passing energy.

As one can see from [1, 7–9], the structures of self-organization are created dynamically in motion of something that moves much faster than the structures oneself. They exist due to a constant motion of the energy which forms them. They are very sensitive to informational exchange with them, which can destroy or restore their structures (see works of Kalnin's group on creation of associative memory on Benar cells [1] and Pyragas works on control of dynamical self-organized chaotic systems by delayed informational feedback [9]).

With such a feedback one can describe conservative action of the exchange with external spatial memory via the memory carriers moving with some speeds in the scale of speeds existent in that space. As it was shown in [9], the feedback in the form of difference between current value of controlling parameter of the system and its past value becomes zero after a while. The system synchronizes its dynamics with its past due to a temporary external influence.

That is not the case if the system of self-organization has the influence constantly in the form of weak and fast disturbances on its variables. Primary role of these disturbances can be to neutralize external stochastic disturbances, which tend to destroy the system.

If the self-organized system has its structure steady, it has both stochastic and purposely formed disturbances in balance. If we are going to introduce another level of associative influence on the self-organized system, it has to be directed to find a dynamical match for conditions of energy transfer between fractal structures of different scales.

Due to the high sensitivity of the systems of self-organization to such an external inputs, they can be a good tool for search of the conditions for this energy transfer.

Mostly appropriate for this is the systems with high numbers of collisions. The collisions can be regarded as described above memory systems, which may receive external energy inputs during time of collisions. If dynamics and form of motion of one colliding object are to be considered as "address", the same characteristics to be received by another object - as "data". This idea with its prospective applications is considered in more detail in [10].

Simplest illustration of this idea together with example of self-organized system with external support in the form of associatively coming perturbations is presented using modified example of simulation of bouncing ball in HyVisual Ptolemy system [11]. When the speed of bouncing ball decreases below certain level, it comes to range of "addresses" appropriate for associative external energy inputs as "data". Without this the ball has decaying dynamics shown on Fig. 1. The dynamics of self-organized system receiving associative external energy support is shown on Fig. 2.

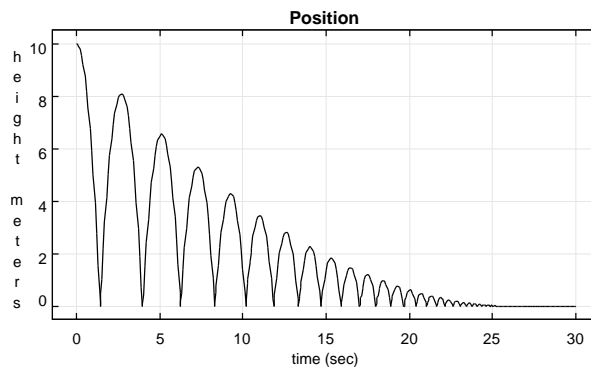


FIG. 1:

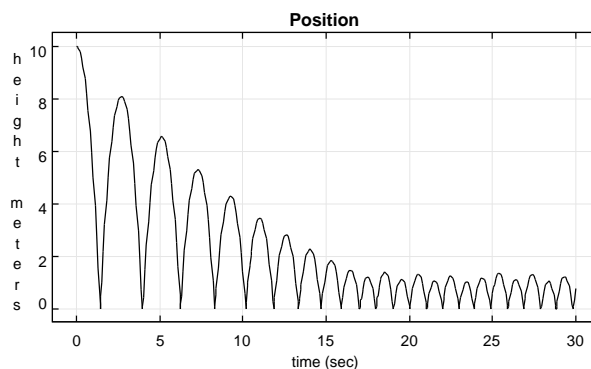


FIG. 2:

4. Conclusions

General suggestion to use self-organized structures for creation of energy sources was formulated in introduction to this paper. The suggestion has been described in more detail and enriched by suggestion to use intermediate structures intentionally formed on physical macro level with an aim to come to interference with fast motion forming structures on other logical levels. The levels might be levels of quantum molecular, atomic and nuclear interactions on micro scale, or levels of various processes in local planets and star.

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