BASIC CONCEPTS OF THEORY OF INFORMATIONAL SPECIES (TIS), SEEN THROUGH THE PRISM OF A SPECIFIC INDUSTRIAL APPLICATIONS

Nicolae Florean PINTE[1], Costică NIȚU[2], Marius Nicolae OLTEAN[3]

Teoria Speciilor Informaționale este o nouă tehnică în inteligența artificială, ce foloseşte (utilizează) un nou mod de tratare a informației, şi anume o tratare culturală, croită, atât cât a fost cu putință, pe calapodul minții umane. Conceptele introduse în inteligența artificială, cu prilejul acestei noi teorii, concepte precum: specie informațională, joc flexibil, chei mentale, salt mental etc. sunt, în integritatea lor, contribuții absolut originale în sprijinul inteligenței artificiale. Succesul de care se bucură în aplicațiile tehnice concrete - vezi cele aferente articolului de față - este, din capul locului, o garanție în dezvoltarea pe mai departe a acestei teorii.

Informational species technology is a new theory in the field of artificial inteligence. It uses a new method of information processing, namely cultural processing, tailored as much as possible on the mechanism of the human mind. The theory introduces a few new concepts to the artificial intelligence field, such as informational species, flexible game, mental keys, mental leap, etc. These are entirely original contributions aimed at developing the artificial inteligence domain. The high rate of success of this method to real technical applications – such as the ones described in this paper – is an important stimulent for further developing this tehory.

Keywords: Theory of Informational Species, informational species, flexible game, mental keys

1. Introduction

Theory of Informational Species (TIS) is a new technique used in Artificial Intelligence (AI), which promotes a new way of processing information, namely, a *cultural treatment*, tailored, as far as possible, on the human mind model.

Now, what distinguishes it from the classic AI techniques, as well as about the new concepts introduced by the TIS in AI, we had the opportunity to talk with many other occasions (see for example [1] and [2], and also the numerous papers present in some important national and international conferences). And then what

[1] Eng., SC Pintel Intelligent Systems SRL Bucharest, e-mail: floreanpinte@yahoo.com
[2] Eng. PhD, Dept. of Automation and computers, University POLITEHNICA of Bucharest, e-mail: cnitu_upb2001@yahoo.com
[3] Eng., SC Smart SA, Sibiu Branch, e-mail: marius.oltean@smartsb.ro

is the purpose of this article? The purpose is to seek to use new forms of explanation of these basic concepts of TIS, which clearly and concisely summarize the core of artificial intelligence promoted by TIS.

For this, all the effort to achieve the goal will be made, not in general and theoretical, but closely related to one specific / practical industrial applications of TIS, namely: "Revolution measuring and control digital module for an induction generator", application which is now in series production. And to further simplify things, we focus in this application, only on the shaft revolution measurement.

Now, as everyone knows, revolution is one of the most measured non-electrical parameter. So, over time, it have been developed all kind of methods and transducers to measure it. The field seems virtually closed, until now. Just seems, because as we will see, the involvement of the TIS artificial intelligence brings even in this ancient -and deep classical- industrial application, a new approach.

2. A classic method for measuring revolution

Here is presented in Fig. 1, one of the classic methods for measuring revolution.

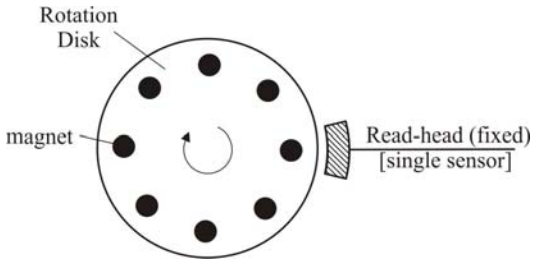

Fig. 1. Classic method for revolution measurement

Summarized in a few words, the traditional method starts by counting the distinct reference marks (e.g., micro magnets in this case) -marks that fitted a disc mounted jointly with the shaft whose revolution is measured- passing in a quantum of time (for example, in a second), against of a fixed reading head, a head equipped with a magnetic sensor (Hall sensor). [A sensor that, with each magnet detected, emits an electrical pulse]. And in the end, the electronic of that transducer to take into account the number (**No**) of pulses, finding revolution value by simply applying of the basic formula: **n** [rpm] = **60 • (No : k)**, where 60 is from: 1min. = 60 seconds, and k is the number of distinct reference marks (micro magnets) of rotating disc.

3. The issue of traditional method

Apparently, the traditional method is as robust and as safe as possible. But what happens if, for whatever reason, one -or more- of the eight magnets are broken or demagnetized, or due to mechanical vibration of generator, etc. the reading head is de-positioned in some way? The answer is simple: In this situation, the reading head, gets / reads – in every rotation of the disc -only a part of the magnets and, therefore, will emit -accordingly- a smaller number of pulses. So, the revolution value, provided by the electronic of transducer, designed only based on traditional method -which does nothing more than to count pulses and finally apply the formula "**n = 60 • (No : k)**"- will be a wrong one. Which creates, further, major shortcomings in controlling the operation of induction generator, which can reach -why not- even to its damage (for example, when generator's connection to the network is done -due to revolution measurement errors- at a revolution whose value ranges over the synchronism revolution).

4. How TIS solved this problem?

[Warning! Answering to this question, we also foresee the needs that have led to the TIS. So as the TIS appeared: From a need, from the need for survival and renewability of information -taken within a phenomenon- being in strongly informational perturbed fields (see electromagnetic interference, etc.), or in situations such as that described above, which mechanically affect the observations of applications phenomenon, so on…]

Fig. 2. Informational Species

Solution -in general- offered by TIS, is to make from **Information**, **Informational Species**, to shift from Information to Informational Species. Which happens –basically- by cultural dressing, in three cultural layers (see Fig. 2), of the Information (**Data_i**). Let's present in a few words -and in general- the three *cultural layers* of Informational Species.

Here. The ***third*** cultural layer of Species, ***Features*** *layer*, is removed from the Application's fundamental phenomenon features (from those features that "*are born and die*" together with the phenomenon) and consists of a Relationship

Whole within the observations of that phenomenon can be related and inter-related, on the basis of Application phenomenon features key[14], the observables of the phenomenon.

> Note 1. Regarding to a feature which *is born and dies* together with the phenomenon, here, for example, if the phenomenon is let's say an elephant, then the elephant's trunk is a good example of such a feature. Is born and dies together with the phenomenon (the elephant). [It is sufficient to see his trunk, even if you do not see the body, and I know he's an elephant.]

The first cultural layer of Species, ***Meaning*** *layer*, is the Meaning -the mental (cultural) key / The Relational whole- which can be given by a multicultural Mind, to the phenomenon's observables Whole.

The second cultural layer of Species, ***The Awareness of the Whole*** *layer of the Species*, is obtained by relational merging / combining of Features layer / key, with the layer / key of one of the multicultural Mind Meanings.

> Note 2. A very suggestive explanation of this concept "***The Awareness of the Whole***" can be offered by a group of soldiers. For example to say that in a military group, each of the soldiers are aware of their place within that group (they know each other, they know each other's place in the group, so they know which is followed by which, in other words they know the group's whole), is in TIS the same as saying that soldiers have an Awareness of the Whole. If we spread them out from group's formation and then ask them to return again in the same formation, they will immediately and unmistakably align one behind the other according to the group's Whole Awareness.

Once created the Informational Species, a cultural/relational template is virtually created, in which must be structured the information that entering in the informational and decisional field of Application, to be able to tell –safely- that the information belongs to Application's phenomenon and not to some informational parasites etc.

What we effectively do in fact (see fig.3 and fig.4) within Species's construction? We insert (see fig.3), we inter-relation in phenomenon's Features cultural Layer, one or the other Meanings that can be given by a Multicultural Mind to the phenomenon's observables whole, building in this way the layer of the Awareness of the Whole (which is basically the informational Species). Or, in other words (see fig.4), we interwoven into the Awareness of the Whole layer the knowledge about the Application's phenomenon itself, taken from other cultural areas.

[1] It is about the Aplication's phenomenon itself.

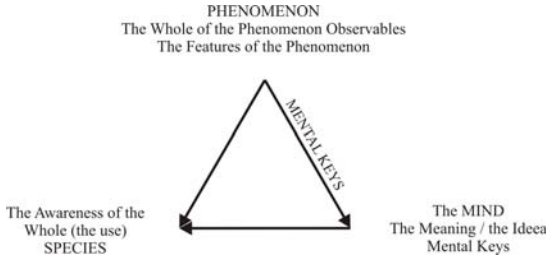

Fig. 3. An explanation of the building of the Consciousness of the Species's Whole shell

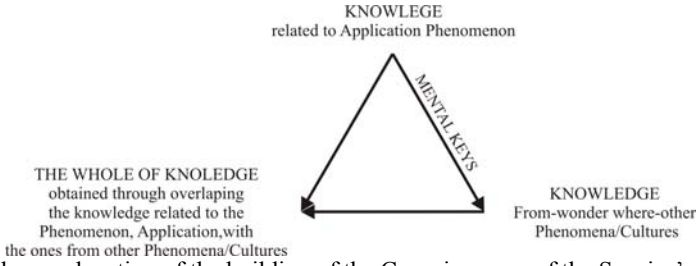

Fig. 4. Another explanation of the building of the Consciousness of the Species's Whole shell

And now after these few explanations, let's return to the actual construction of the Species (i.e. the Species's Awareness of the Whole) of this Application.

Here, the Fig. 5 below summarizes in one picture all this cultural construction.

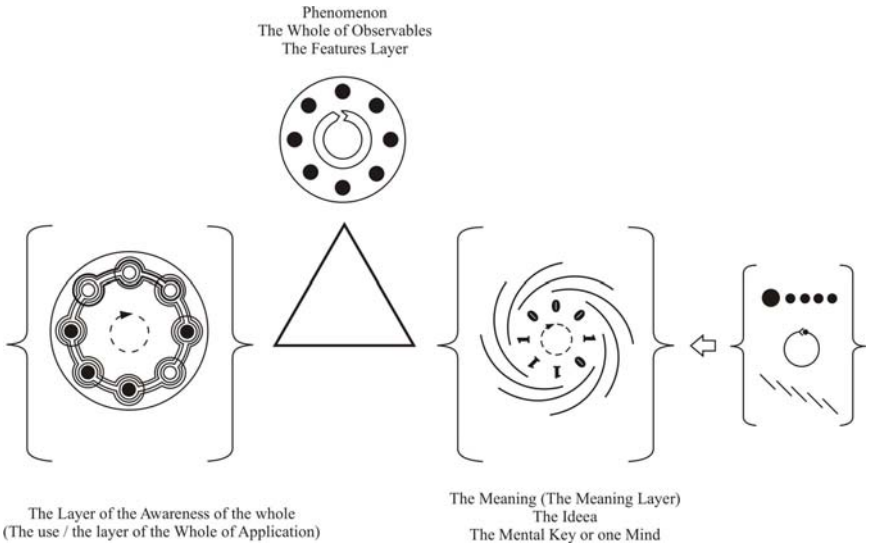

Fig. 5. The construction of the Informational Species (Awareness of The Whole)

Let's look over the "*semiotic triangle*" of Fig.5, where at its corners is registered this construction.

In the past, as can be seen, we put in ***the top corner*** of triangle the Application's phenomenon *Features layer*. The application's phenomenon being *the rotation, the Features layer* that are born and die together with this phenomenon, and within can be related the phenomenon's observables (i.e. micro magnets), consists of two features: observables sequence, and, respectively, closed contour of this sequence.

At the triangle's ***right hand corner***, we first put three mental keys / three *Ideas/Meanings*, that a multicultural Mind can give/find, seeing the phenomenon's observables Whole (thus seeing the same observables Whole on which account the Features cultural layer was, in fact, woven), respectively: sequence key, closed contour key (key of "snake biting its tail") and cultural key in which the wood shingles on a roof are binding. Following that through the relational combining of these three keys, to obtain a much more complex key (see key figured in the close proximity of the right hand corner of triangle) that we named it, metaphorically, the key of "whirlpool".

At the triangle's ***left hand corner,*** it is recorded the Awareness of the Whole layer (i.e. the overall cultural pattern of Informational Species) obtained by relational interwoven/relational combination of Features layer/key itself of Application's phenomenon, with the layer/key of Meaning given to Application's phenomenon observables Whole by a multicultural Mind.

Now, once we have built purely relational the cultural aspect of Application's Species (or more precisely, of Species Awareness of the Whole layer), we will move from *qualitative/relational* to *quantitative*, occasion in which we appeal to one of scientific instruments offered by scientific knowledge, by which to translate into *practice* the ideas/keys/pure relational template that we built "along and across" the semiotic triangle. In this case, we chose to appeal to computer science tool, to the bits code, so on.

Before we actually use the tool of computer science, and before we practically transpose the Species's Awareness of the Whole, let's look again to this Awareness. Let us see for example the eight blades, the eight individuals overlap and concatenate in the key chain of "whirpool" like in a round dance -of a group of eight individuals / opt soldiers- transforming our anonymous Fig.1 disc with magnets -that of classic method- into the one personalized, such as below -of the Fig. 6-; disc/round dance/Species in which, to be as suggestive, we proceeded to give -symbolic- names to their respective individuals.

Fig. 6. The "hora" of the eight individuals

Note 3. Now you understand until the end the significance of Awareness of the Whole concept? See?, We are dealing with eight soldiers/individuals that are interrelated (they know each other etc..), so if for some reason, the read head does not catch (no sees) than some of these individuals, he will place *he from him* the missing individual –or individuals- based on known Awareness of the Whole of the group.

Therefore to appeal to announced scientific instrument of computer culture. According to this culture, to encode eight distinct individuals, I need eight different combinations of three bits[1] of information. The binary code -given below- is a good example of doing this:

000
001
010
011
100
101
110
111

Now, inter-relating these eight combinations/individuals -each *combination/individual* in its turn consists of three bits- according to Species Awareness of the Whole, i.e. as the cultural key of "whirlpool", we get (see Fig.5 and more precise, the direction of scrolling the key of Meaning/ "whirlpool" key) the following arrangement of individuals: **000, 001, 010, 101, 011, 111, 110 and 100.**

Finally, to move from *theory* to *real* (*material/dimensional/sensory*), we replace bits 1 and 0, with *micro-magnets* and respectively "*missing magnets*", getting the Whole of observables from fig.7 below, where we figured also a Read head for reading the respective individuals (combinations of three observables).

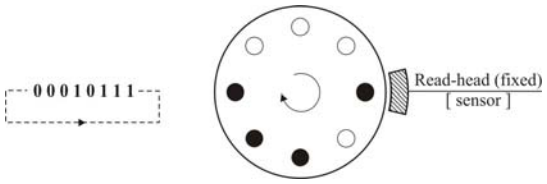

Fig. 7. The Whole of observables of the TIS Aplication's transducer

Note 4. If the respectively transducer is used in a different type of application (for example, as position transducer) -see [1] and [2]-, then the Disc with magnets looks similar to Fig.8, where the Reading Head is equipped with three magnetic sensors (Hall) for reading these observables and where, for good reading/perception of observables, the disc is equipped with Good Perception tacts -tacts made of pointers/small magnets- and therefore the Reading Head has additional a magnetic sensor for reading the respective pointers.

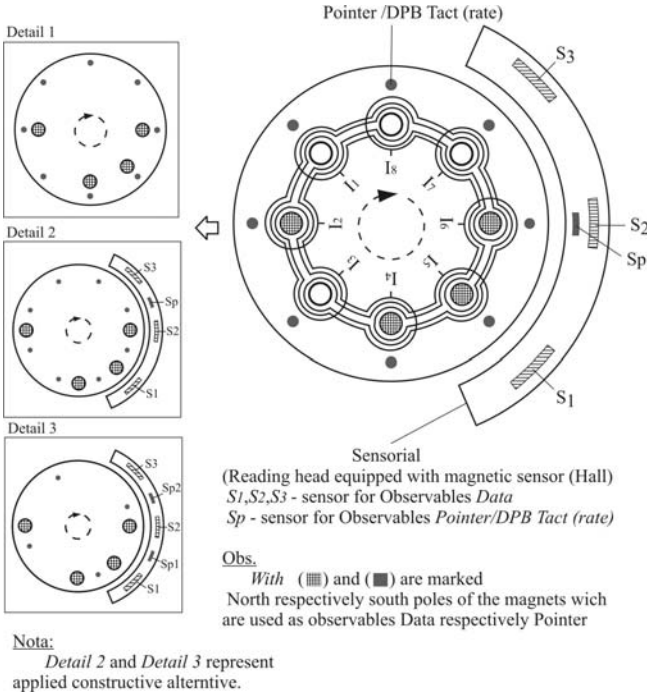

Fig. 8. A conviction look on a position transducer used in a TIS Application

We concluded, in general terms, the Informational Species construction.

So, unlike the traditional method, here we are dealing with a observables Whole, ordered by a certain Awareness of the Whole, and not with eight

anonymous magnets, that do not know each other and where the lack of one or other pass unnoticed by the Reading Head and associated electronics, leading finally to calculate a wrong revolution. So, here, in the new method, the information taken from the phenomenon is first analyzed, recognized -and regenerated, if necessary- i.e. in other word said, informational *validated*, and only then offered to computer -rigid- algorithms - related to Application Main Program, the one that at its output post the numerical value of revolution.

Therefore, unlike the classical method, passing from Information to Informational Species, entails a fundamental difference in the structure of the classic Applications Main Programs vis-à-vis by the ones developed with TIS. That is, unlike the Main Program from traditional developments, a Program containing *only* rigid algorithms (Rigid game) of calculation with classical Information (Data_i), in the TIS Main Program also contains, beside the Rigid Game, a flexible Game of construction and Validation of the Species / Information, Game which makes that only after the Information / Informational Species is recognized and informational validated -as belonging by rights to the phenomenon of Application - to be offered then to Rigid Game (rigid algorithms) of achieving the Purpose of the Application (purpose which, in this case, consists in finding the shaft revolution). Fig. 9, below, provides a picture in which the conceptual differences between classic and TIS, can be seen even with "the naked eye".

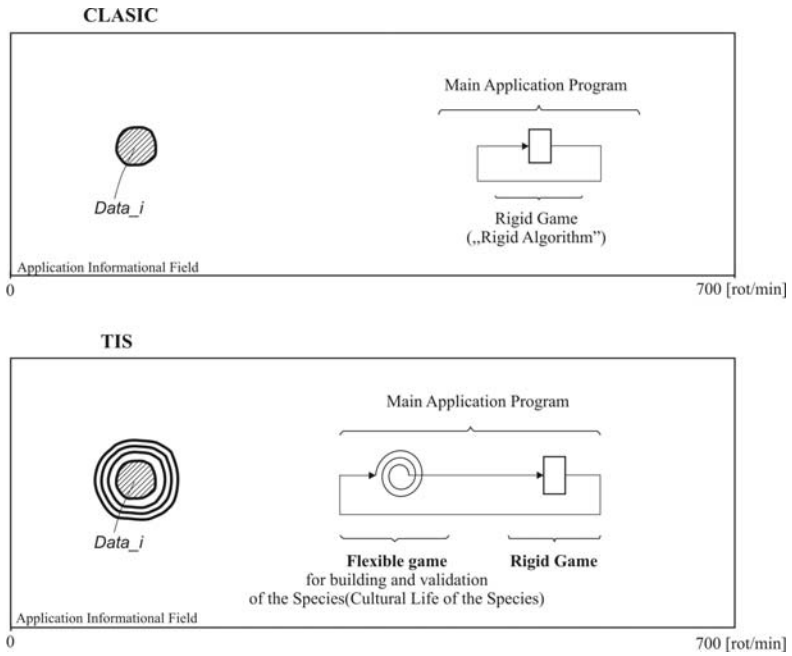

Fig. 9. Classic versus TIS

We will not conclude, however, the sketchy discussions about Flexible Game of one of TIS Application Main Program, before presenting in general lines -as an example- the logical diagram of one of the *validation criteria* of Application's Species, criteria emerged due to the Awareness of the Whole and Good Perception Dimension -GPD attached to Awareness of the Whole-. ... And to be more explicit I'll take for example, the Awareness of the Whole and GPD related to position transducer whose Disc with magnets and reading head is shown in Fig.8, and such I will introduce the stub of the promised logical diagram, realized on the recognition and validation of the latter specified Awareness.

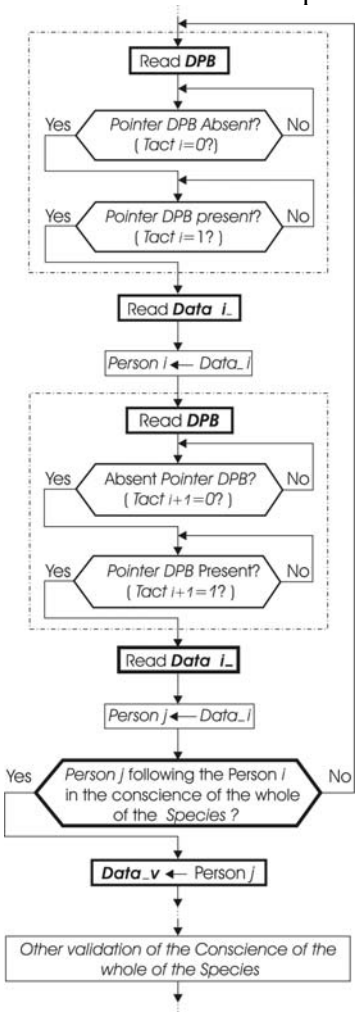

Fig. 10. Logical organizational of a validation criteria of the Species' Consciousness of the Whole

And also to feel, as more in his depth as possible, the actions of flexible Game of construction and validation of Informational Species, in fig. 11 we offer you a picture, where we put -linearized- few turns of the Disc with magnets, which rotations sometimes we may face with the lack of observable magnets, and where flexible Game seeks to validate -on the before known Awareness of the Whole of the Species- the Informational Species.

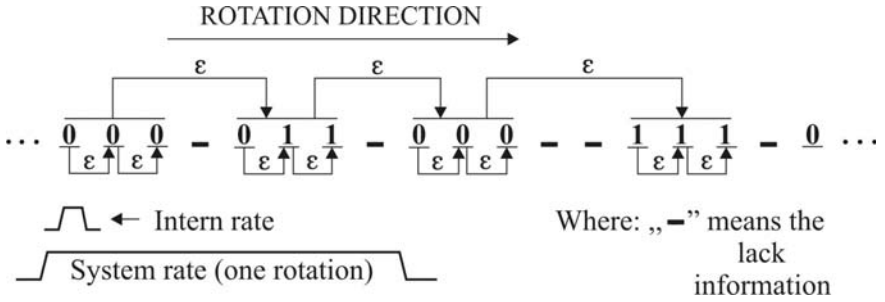

Fig. 11. Validation of the Species taken in the flexible Game

Note 5. "**ε**" in Fig. 11 marks/represents/symbolizes the validation criteria, validation that happens (starting from the most basic observables and up to the level of Observables Whole) every time when what the sensor (reading head) reads is in agreement with what must be in fact -according to before known Awareness of the Whole- in that site/part of the rotating Disc.

Now finally, we need only to attach some pictures of two of the industrial products that are based on the technology -related TIS- presented throughout this paper, namely "Revolution measuring and control digital module for an induction generator, type. MTGA-01 "(see Fig. 12) and "Digital transducer for on load tap changer (OLTC) position acquisition, type. TDKP-19V "(see fig. 13).

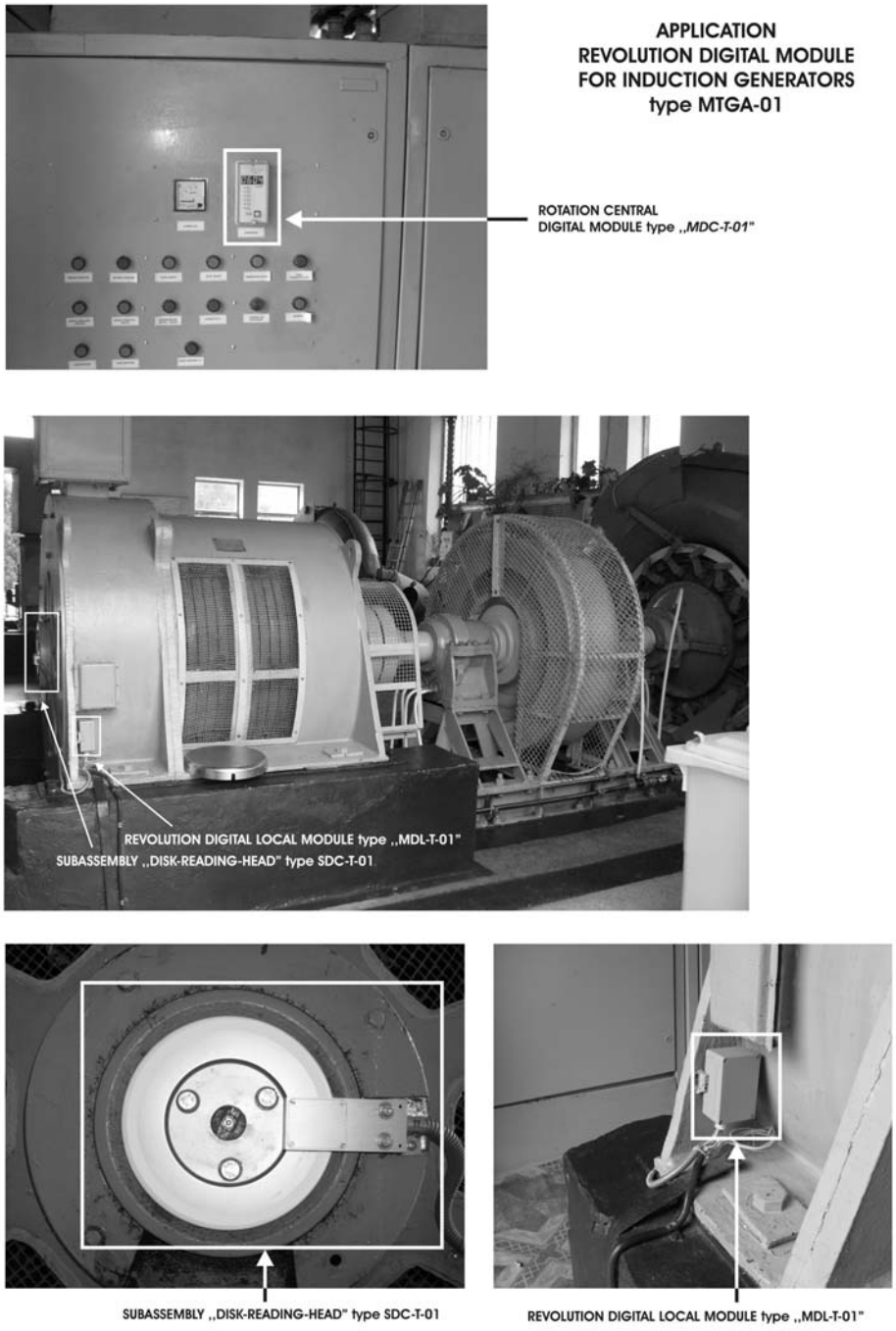

Fig. 12. Images related to framing practical, field installations, of MTGA-1

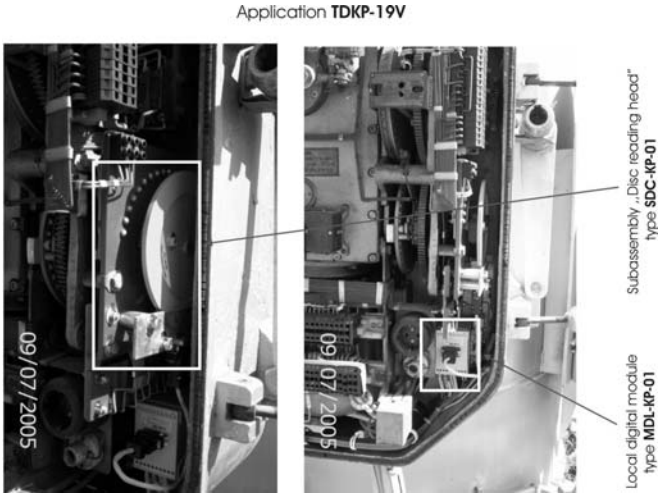

Fig. 13. Images related to framing practical, field installations, of TDKP-19V

6. Conclusions

The transition from *Information* to *Informational Species* (by putting cultural layer to Information) is just one of the new concepts introduced by the TIS in Artificial Intelligence. And TIS Artificial Mind approach to the *inner side of thought / intelligence of the human Mind* (*inner side* of which did not miss the finest and first productions of the human Mind, such as: *Meaning / Idea, Metaphor, Dream, etc.*) is just one of the important steps that TIS makes into the Artificial Intelligence field [2].

Now, regarding the TIS concrete applications, and more precisely in some industrial products, where Artificial Intelligence is the technique developed by TIS, products like the two examples in this article (MTGA-1, respectively TDKP-19V), we have to say, on the one hand, that they behave flawlessly in field installations, and on the other hand that some of them (for example TDKP-19V) are present for years and widespread in the Romanian energy system.

R E F E R E N C E S

[1]. *N.F. Pinte*,Theory of Informational Species, Editura Irecson, Bucharest, 2007
[2]. *N.F. Pinte,*Theory of Informational Species in Artificial Intelligence, Editura Semne, Bucharest, 2011
[3] *N.F. Pinte,* The Theory of Informational Species, a new theory in the field of artificial intelligence, CSCS-14, Bucharest, 2003
[4] *N.F. Pinte*, Informational Species in Artificial Intelligence, WESC, Iasi 2008
[5] *N.F. Pinte, C. Nitu, C. Muntean, I. Diaconu, E. Merdan, M. N. Oltean*, TIS Cultural Filtration, Implemented within the Directional Relay Structure, MPS 2008, Cluj-Napoca

[6]. *N.F. Pinte, P. Postolache, C. Nitu, Petru Ruset, S.A. Gal, M.N. Oltean,* Theory of Informational Species And Its Implications In The Power System Protection, Measurement And Control Systems, IEEE - Power Tech, Bucharest, 2009
[7]. *N.F. Pinte,* Absolute Numerical Displacement transducer, Innovation patent, RO 121492B1.
[8]. *** PINTEL INTELLIGENT SYSTEMS -Technical brochures, Bucharest.