SEMIOTIC MODELLING OF THE GRAPHS

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Abstract: Semiotic Modelling of the Graphs (called also Semiotics of the Structure) is a domain of research on the frontiers of ***graph theory*** and ***semiotics***, which investigates the abstract concept of ***structure***. It is an approach to modelling of the graph's structure with exactness up to orbits and isomorphism. This enables to open some "hidden sides" of the graphs, to solve some of the classic problems in non-classical manner, and to set and solve the new ones.

1. THE INITIAL PRINCIPLES

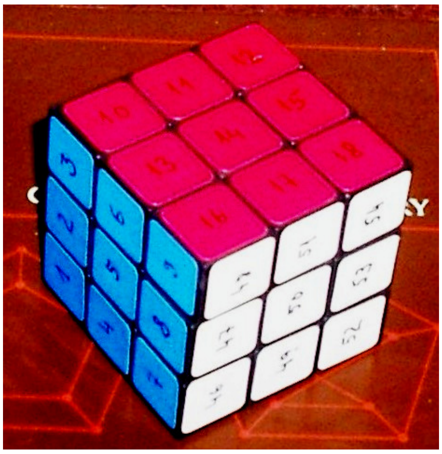
1.1. System, Structure, Graph and Semiotics

What's the difference between such associations or connected sets as a *system, structure,* as well a *graph*. All three consists of ***elements*** and their ***relationships.*** The ***system*** is *many aspects* where therein have an important role their ***empirical properties*** of elements and relationships. In case of the system be interested on their ***function*** and ***structure***.

The concept of structure is devalued to a fuzzy adjective of each object. On the other hand, it is sure characteristic of the associations. ***Structure*** constitute ***an abstraction of the system***, its "skeleton", where its elements and relationships are lose at empirical properties but retain their qualitative distinctness in the form of different ***positions*** in the structure. Structure (Latin word *structura (inner)building*) is defined as a *connection, permanent relationship* or *organization manner* of system's elements [Schmidt], [Новая]. It is argued that to ***explicate*** (interpreter) of the "structure as such" is a ***graph.*** All the structural properties are explained by a *graph,* including the *positions*.

Concepts of *system, structure, position and graph* are easily and pictorially explainable on the ***Rubik's Cube.*** To this end, let's look at a Rubik's Cube and answer to two questions:

1. **Which positions have the elements of the cube?**
2. **With layers turning of the cube be changed its structure or system?**



Answer 1. In Rubik's cube has each facet 9 elements, so on all the facets are 6x9 = 54 elements. Each facet has one element in the *middle*, four elements in the *edges* and four elements in the

angles. Thus, the 6 elements of the cube represent a ***"middle position"***, 24 elements an ***"edge position"*** and 24 elements an ***"angle position"***.
Answer 2. With turning the layers of the cube, although ***be changed the system,*** because the relationships between its empirical properties of the elements (i.e. colors) changes. However, the ***structure does not change***, because the ***positions are remain.***

Rubik's cube as a system is also many aspects. If we had adopted to its elements the faces, we would produce a 6-cell system, in case of angles we can obtain a 8-elements and by edges a 12-elements system. The ***function*** of Rubik's system is derangement and reconstructing of concolorated facets. The ***structure*** of Rubik's cube can depict in the form of a *graph*. For example, each element of this cube has four neighbors: "upper", "lower", "right", "left" and can be presented as a graph, where its 54 vertices divide to ***the three positions***. As a rule is every structure presentable in the form of a graph and is intimately related with ***invariance*** and ***isomorphism***.

A graph is defined as a formation of non-empty set $\boldsymbol{V}$ and element pairs $\boldsymbol{E}$ of this set $\boldsymbol{E} \subset \boldsymbol{V} \times \boldsymbol{V}$, which to adjacent elements called. Such formation can be treated on various aspects. In the course of time branch the graph theory on various aspects to *algebraic, algorithmic, combinatorial, extreme, fractal, random, spectral, structural and topological graph theories.* C. Berge [Berge] takes for graph theory as "theory of pair relations". This thought is near with structure semiotic understanding on "theory of pair systems". Actually develops and expand graph theory spontaneously, it no has a certain "general plane". To explicative inducement can be pure curiosity.

The objective of semiotic modelling is to represent and ***describing*** the graph structure in a ***canonical form*** with exactness up to *positions* and *isomorphism.*

This problem is ***heuristic***. To research objects of Heuristics are *thought and creative processes, large systems and their formalization efforts.* Modern heuristics is also related to ***artificial intelligence*** problems. Complexity of the large systems and graphs make their analyzing and design with exact mathematical methods impossible. Heuristics arise as soon as there appear an alternative – and it is almost always subjective. As we see heuristics is unavoidable for IT and other fields.

To one of heuristic methods is ***semiotics.*** It is a discipline of the *signs and sign systems* which study the *meaning, communication- and interpretation processes.* The development and implementation of majority the semiotic methods based on the investigation of such systems, which have sufficiently clearly expressed *structure* on the one hand and on the other hand sufficiently clear means for *expression of their attributes.* Semiotic investigations encourage formalizing the new areas and in the border areas emerged disciplines, as well as areas for research within this on a *new aspect.* A ***sign*** in semiotic system of sensually perceptible object (a thing, phenomenon, condition, event), which *represents, mark or describe* from its self different object, its *properties, meaning or thought.* You might say that is a sign of a *concentrate of the object,* by help which stored, processed and forwarded the information. An object is a sign only in a sure relation with the other signs which participate in the same process and are the same type. In case of signs be differentiated its *meaning* (i.e. indication function, which it present), and its *thought (sense)* (i.e. with a sign associated content of thought).Sign is related with ***cognition*** and ***thinking.*** Sign is a submission for an object.

Semiotics is characterized by pluralism, to attract attention and orientation to the specific labels – *discern- and sign systems*. Semiotics are many, in the areas of arts and science. By W. Nöth [Nöth] exist a ***semiosphere*** where belong at cultural semiotics to computer semiotics. One of the first semiotic was *Semiotics of Mathematics* [Hermes]. Semiotics is ***inter-disciplinal.*** Semiotics of the structure is one of the many kinds of object-oriented semiotics.

To structural signs are the ***semiotic invariants*** of the graphs [Tevet].

1.2. Graph, its semiotic model and accompanying graphs

Issue from hypothesis that the structure of the graph is recognizable with exactness of isomorphism by identification its “basic-particles”, i.e. vertex pair ***ij***.

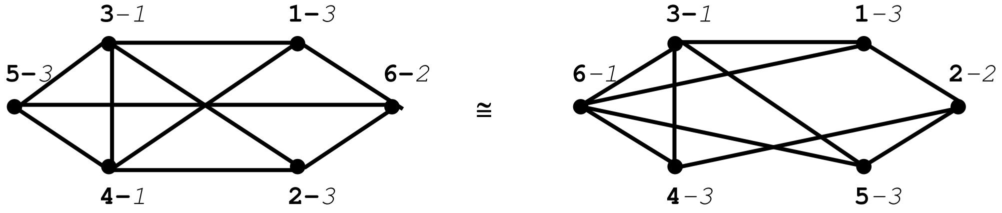
Let identify a vertex pair ***ij*** its specific “relationship” between their in the form of *intersection of neighborhood*, $N_i \cap N_j$, as a partial graph, called ***pair graph***. Corresponding ***semiotic identification algorithm, SIA*** [Tevet 27, 36, 49]**,** fixate all the pair graphs and their *semiotic invariants*, called ***pair sign***. An *ordered system of pair signs* called ***semiotic model*** **SM.**

__**Semiotic Identification Algoritm *(SIA).***__ OPERAND: *List the adjacent vertices* ***L.*** ALGORITHM: 1) Fix an element ***i*** and form its neighborhood N_i, where the elements, connected with ***i***, are divided according to distance ***d*** to entries C_d. 2) Fix an element ***j*** and form its neighborhood N_j by condition (1). 3) Fix the intersection $N_i \cap N_j$, as a *pair graph* g_{ij}, and fix its invariants in the form of a pair sign $\pm d.n.q._{ij}$. 4) Realize (1) to (3) for each pair ***ij, i,j***∈[*1,* |*V*|]. 5) Obtained preliminary semiotic model. Fix for each vertex (row) ***i*** its *frequency vector* u_i of pair signs. 6) Decompose the preliminary semiotic model **SM** by *frequency vectors* u_i lexicographically to partial models $\mathbf{SM}_k$. 7) In the framework of $\mathbf{SM}_k$ decompose the rows and columns by class vectors s_i lexicographically to complementary partial models $\mathbf{SM}_k$. 8) Repeat (7) up to complementary decomposing no arise. RESULTS: **a)** ***Semiotic model*** SM; **b)** *The lists of vertices* $\{B_{ij}\}$ *of pair graphs.*

Thus, the ***pair sign*** is a quadruplet $\pm d.n.q._{ij}$, where $+d$ show collateral- and $-d$ ordinary distance between vertices v_i and v_j, n – number of vertices and q – number of edges, in this pair graph g_{ij}.

It has been suggested the pair sign to *measure (size)* called. Indeed, it has the properties of measure. But yet, this is pointless, because in this case, need is a ***description*** of the condition of vertex pairs.

__**Example 1.1.**__ Graphs G_A and G_B and their ***semiotic models*** $\mathbf{SM}_A$ and $\mathbf{SM}_B$



A:-2.5.7; B:-2.5.6;
C:+2.3.3; D:+2.5.7; E:+3.6.10.

1	*1*	*2*	*3*	*3*	*3*		u_i	k	s_i
3	**4**	**6**	**1**	**2**	**5**	***i***	*AB***CDE**		123
0	***D***	*-B*	***C***	***C***	***C***	**3**	*01***310**	*1*	103
	0	*-B*	***C***	***C***	***C***	**4**	*01***310**	*1*	103
		0	***E***	***E***	***E***	**6**	*02***003**	*2*	003
			0	*-A*	*-A*	**1**	*20***201**	*3*	210
				0	*-A*	**2**	*20***201**	*3*	210
					0	**5**	*20***201**	*3*	210

A:-2.5.7; B:-2.5.6;
C:+2.3.3; D:+2.5.7; E:+3.6.10.

1	*1*	*2*	*3*	*3*	*3*		u_i	k	s_i
3	**6**	**2**	**1**	**4**	**5**	***i***	*AB***CDE**		123
0	***D***	*-B*	***C***	***C***	***C***	**3**	*01***310**	*1*	103
	0	*-B*	***C***	***C***	***C***	**6**	*01***310**	*1*	103
		0	***E***	***E***	***E***	**2**	*02***003**	*2*	003
			0	*-A*	*-A*	**1**	*20***201**	*3*	210
				0	*-A*	**4**	*20***201**	*3*	210
					0	**5**	*20***201**	*3*	210

Comments: **a)** Different graphs $G_A \neq G_B$ have here equivalent semiotic models $\mathbf{SM}_A \approx \mathbf{SM}_B$! This means, that the graphs are ***isomorphic*** $G_A \cong G_B$ or structures are ***equivalent*** $GS_A \equiv GS_B$. **b)** The vertices have ***three positions*** and vertex pairs are in ***five positions.*** **c)** The substitutions between G_A and G_B take place with exactness of positions of vertex pairs. **d)** Pair signs represent sentences, for example, ***E: +3.6.10*** means: *the vertex pair belongs to more than one girth with length d= 4.* **e)** In case of symmetric structures we use adjusted pair signs.

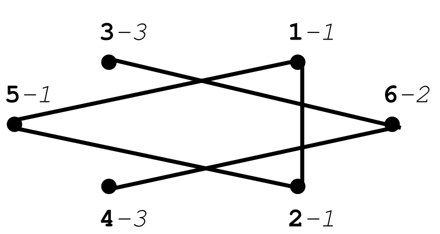
The semiotic model constitute a *text of structure* (see Chpt. 2), its *canonical submission* (Chpt. 3.1) which is the basic tool to *investigate the structures.*

It is useful treat also the ***accompanying graphs*** of a graph, such as *complement, pair graphs, sign graphs* and *adjacent graphs.*

The structure be studied (investigates) *in an integrated way*, in conjunction with its *complement.*

<u>**Example 1.2.**</u> The ***complement*** $\urcorner G_A$ of G_A and its ***semiotic model***:

```
A:-2.3.2; B:-0.2.0; C:+1.2.1; D:+2.3.3.
```



```
| 1  1  1| 2| 3  3|       u_i    k
/ 1  2  5| 6| 3  4|   i   ABCD       123
| 0  D  D|-B|-B -B|   1   0302   1   200
     0  D|-B|-B -B|   2   0302   1   200
        0|-B|-B -B|   5   0302   1   200
         | 0| C  C|   6   0320   2   002
            | 0 -A|   3   1310   3   010
                 0|   4   1310   3   010
```

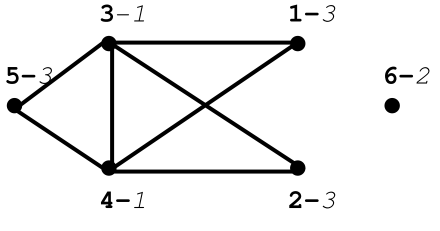
<u>Comments:</u> **a)** The ***positions*** of vertices in G_A and its *complement* $\urcorner G_A$ ***coincide.*** The substitutions between vertex positions: *1→3, 2→2, 3→1.* **b)** Coincide also the ***pair positions***, but if G_A has *three edge and two non-edge positions* then in complement $\urcorner G_A$ is it in *contrary.*

<u>**Definition 1.1.**</u> An intersection $N_i \cap N_j$ of neighborhoods of the vertex pair ***ij*** called ***pair graph*** g_{ij}.

Pair graph be characterize the condition of a vertex pair, *pair sign* is only its invariant. In some cases, it is necessary to open the *semiotic model of pair graph* for adjustment of corresponding pair sign (Prop. 1.1.2).

<u>**Example 1.3.**</u> ***Pair graph*** $g_{3.4}$ of the vertex pair 3-4 ***(D)*** of G_A and its ***semiotic model*:**

```
A:-2.4.5; B:-0.2.0; C:+2.3.3; E:+2.5.7.
```



```
| 1  1| 2| 3  3  3|       u_i    k
/ 3  4| 6| 1  2  5|   i   ABCD       123
| 0  D|-B| C  C  C|   3   0131   1   103
     0|-B| C  C  C|   4   0131   1   103
        0|-B -B -B|   6   0500   2   000
         | 0 -A -A|   1   2120   3   200
              0 -A|   2   2120   3   200
                 0|   5   2120   3   200
```

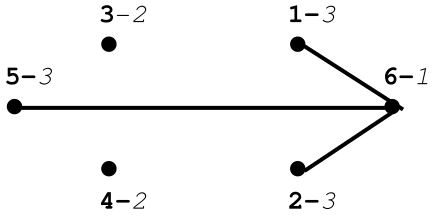
<u>Comments:</u> **a)** Certainly are at the back of signs *A: –2.5.7; B: –2.5.6;* ***C: +2.3.3; E: +3.6.10*** of G_A also pair graphs. **b)** The ***positions preserve.***

<u>**Definition 1.2.**</u> A graph, where its edges correspond to a sign class ***p*** of semiotic model called ***sign graph*** G_p.

Sign graph is one of the key attributes of structure, it can *adjust the pair signs* (Prop. 1.1.3) and investigate the *structural properties*. In some cases it may be turn out to the *position structure* (chpt 2.3).

Example 1.4. ***Sign graph*** $\boldsymbol{G_{p=+E}}$ by ***E: +3.6.10*** of $\boldsymbol{G_A}$, and its ***semiotic model*****:**

A: -2.3.2; *B: -0.2.0;* ***C: +1.2.1.***



1	2	2	3	3	3		u_i	k	
6	**3**	**4**	**1**	**2**	**5**	*i*	ABC		123
0	-B	-B	**C**	**C**	**C**	**6**	02**3**	1	003
	0	-B	-B	-B	-B	**3**	05**0**	2	000
		0	-B	-B	-B	**4**	05**0**	2	000
			0	-A	-A	**1**	22**1**	3	100
				0	-A	**2**	22**1**	3	100
					0	**5**	22**1**	3	100

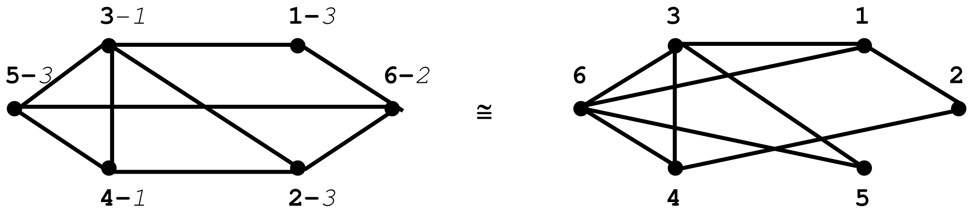
Comments: **a)** Sign graphs $\boldsymbol{G_{p=+C}}$ $\boldsymbol{G_{p=+D}}$ and $\boldsymbol{G_{p=+E}}$ of $\boldsymbol{G_A}$ are its *partial graphs*, whereby $\boldsymbol{G_{p=+C}}$ cover $\boldsymbol{G_A}$ completely and $\boldsymbol{G_{p=+D}}$ only vertex pair 3-4. **b)** Sign graphs $\boldsymbol{G_{p=--A}}$ and $\boldsymbol{G_{p=--B}}$ are partial graphs of complement $\neg\boldsymbol{G}$. **c) c)** Also here the *positions* and *classes* ***remain.***

Definition 1.3. The *greatest sub-graph* $\boldsymbol{G^{sub}} = \boldsymbol{G \backslash e_{ij}}$ and *smallest super-graph* $\boldsymbol{G^{super}} = \boldsymbol{G \cup e_{ij}}$ of $\boldsymbol{G}$ called ***adjacent graphs*** $\boldsymbol{G^{adj}}$.

The number of firsts equal to the number of edges in $\boldsymbol{G}$, number of others to the number of "non-edges".

A sample of *isomorphic graphs* has the same *structure* and we call it simply to ***structure GS.*** Whereas the adjacent graphs, which obtained by the same pair position are isomorphic, *form an isomorphism class* $\boldsymbol{\Gamma_n=\{(G^{adj}{}_n)_1 \cong \ldots \cong (G^{adj}{}_n)_q\}}$, we call this to ***adjacent structure*** $\boldsymbol{GS^{adj}}$. The number of adjacent structures equal with the number of pair classes.

Example 1.5. Two ***adjacent sub-structures*** $\boldsymbol{GS_A{}^{sub}{}_{n=+C}}$ and $\boldsymbol{GS_B{}^{sub}{}_{n=+E}}$, of isomorphic graphs $\boldsymbol{G_A}$ and $\boldsymbol{G_B}$ or of structure $\boldsymbol{GS}$ (see Example 1.1) by pair positions $\boldsymbol{n=+C}$ ja $\boldsymbol{n=+E}$ correspondingly:



$\boldsymbol{DEG=2^1 3^3 4^1}$

A:-2.5.7; B:-2.5.6; C:-2.4.4; D:-2.3.2;
E:+2.3.3; F: +2.4.5; G:+3.5.6; H:+3.6.9.

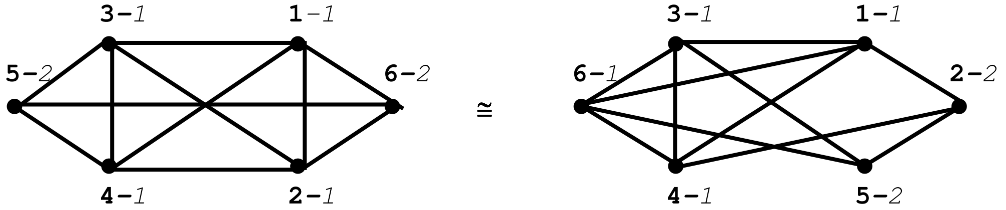
1	2	3	4	5	5		u_i	k
4	**1**	**3**	**6**	**2**	**5**	*i*	ABCD**EFGH**	
0	-D	***F***	-C	***E***	***E***	**4**	0011**2100**	1
	0	***G***	***G***	-C	-C	**1**	0021**0020**	2
		0	-B	***E***	***E***	**3**	0100**2110**	3
			0	***H***	***H***	**6**	0110**0012**	4
				0	-A	**2**	1010**2001**	5
					0	**5**	1010**2001**	5

A:-3.6.9; B:-2.5.7; C:-2.4.5; D:-2.4.4;
E:+2.3.3; F:+2.5.7; G:+3.5.7.

1	1	2	2	3	4		u_i	k
3	**6**	**1**	**4**	**2**	**5**	*i*	ABCD**EFG**	′
0	***F***	***E***	***E***	-D	***E***	**3**	0001**310**	1
	0	***E***	***E***	-D	***E***	**6**	0001**310**	1
		0	-B	***G***	-C	**1**	0110**201**	2
			0	***G***	-C	**4**	0110**201**	2
				0	-A	**2**	1002**002**	3
					0	**5**	1020**200**	4

Comments: **a)** The semiotic models of adjacent sub-structures $GS_A{}^{sub}{}_{n=+C}$ and $GS_B{}^{sub}{}_{n=+E}$, are ***non-equivalent,*** because their adjacent sub-graphs are ***non-isomorphic.*** **b)** Adjacent sub-structure $GS_A{}^{sub}{}_{n=+C}$ is acquired by *removal* the edge 1-4 on pair position $n=+C$ of G_A. There belong also 1-3, 2-3, 2-4, 3-5 and 4-5, where by its *removal* be acquired the same $GS_A{}^{sub}{}_{n=+C}$, i.e. the isomorphic adjacent sub-graphs. **c)** Adjacent sub-structure $GS^{sub}{}_{n=+E}$ is acquired by *removal* the edge 2-5 on pair position $n=+E$ of G_A. There belong also 1-2 and 2-4, where by its *removal* be acquired the same $GS^{sub}{}_{n=+E}$, i.e. the isomorphic adjacent sub-graphs **d)** Third adjacent sub-structure $GS^{sub}{}_{n=+D}$ be acquired by *removal* the edge 3-4 in G_A or edge 3-6 in G_B. **e)** The *vertex positions* and *pair classes* ***are changed.***

Example 1.6. Two ***adjacent super-graphs*** of graphs G_A ja G_B (see Example 1.1). The first is *adjacent super-graph* $G_A{}^{supp}{}_{n=-A}$ of G_A, the other *adjacent super-graph* $G_B{}^{supp}{}_{n=-A}$ of G_B:



A:-2.5.7; **B:+2.3.3; C:+2.4.6; D:+2.5.8; E:+3.6.11.**

```
| 1  1  1  1| 2  2|     ui     si  k       | 1  1  1  1| 2  2|     ui     si  k
| 1  2  3  4| 5  6| i   ABCDE  12  .       | 1  3  4  6| 2  5| i   ABCDE  12 .
| 0  D  C  C|-A  B| 1   11210  31  1       | 0  C  D  C| B -A| 1   11210  31  1
     0  C  C|-A  B| 2   11210  31  1            0  C  D|-A  B| 3   11210  31  1
        0  D| B -A| 3   11210  31  1       ≈       0  C| B -A| 4   11210  31  1
           0| B -A| 4   11210  31  1                  0|-A  B| 6   11210  31  1
            | 0  E| 5   22001  21  2                   | 0  E| 2   22001  21  2
               0| 6   22001  21  2                        0| 5   22001  21  2
```

Comments: **a)** The sign matrices of $G_A{}^{supp}{}_{n=-A}$ and $G_B{}^{supp}{}_{n=-A}$ are ***semiotically equivalent***, what mean, that these are ***isomorphic*** and represent the ***adjacent super-structure*** $GS^{supp}{}_{n=-A}$ of structure ***GS*** by pair position $n=-A$. **b)** Adjacent super-structure $GS_A{}^{supp}{}_{n=-A}$ is acquired by *addition* the edge 1-2 on pair position $n=-A$ of G_A. There can be add also 1-5 and 2-5, what give the same super-structure $GS_A{}^{supp}{}_{n=-A}$, i.e. the isomorphic adjacent super-graphs. **c)** Adjacent super-structure $GS_B{}^{supp}{}_{n=-A}$ is acquired by *addition* the edge 1-4 on pair position $n=-A$ of G_B. There can be add also 1-5 and 4-5, what give the same super-structure $GS_B{}^{supp}{}_{n=-A}$, i.e. the isomorphic adjacent super-graphs. **d)** The other adjacent super-structure $GS^{sub}{}_{n=-B}$ be acquired by *addition* the edge 3-6 or 4-6 to G_A or by *addition* the edge 2-3 or 2-6 to G_B.

Adjacent structures, so as pair graphs, characterize also the vertex pairs. On the other hand their ***successions*** have essential role by simulating the ***evolution processes***.

The successions of *adjacent structures* with fixed number of elements form a *Constructive system of structures*, which is directly related to the ***problem of reconstructions*** (Chpt. 4).

With this are defined all the essential basic attributes for structural researches. ***Structure and graph are inseparable***, all the structural attributes are presentable on the graphs and all the graph attributes are inherent for structure.

1.3. Adjustment and simplification of the model

In common cases are the structures recognizable on the level of initial pair signs, but in case of some symmetric graphs are necessary to use the ***adjusted pair signs***. In the case of solving some practical tasks is suitable the pair signs ***to simplify***.

Adjustment

It is obvious that pair signs in the form ***dnq*** does not always become to complete identifier of vertex pairs. To exact ascertaining the structure of s*ome large transitive and symmetric* graphs is needful to ***adjust the pair signs*** or to ***deep-identify.*** For this be exist any possibilities. Also here assist the ***pair-*** and ***sign graphs.***

Remind, that in pair- and sign graphs no exist anything random. In case of transitive graphs cover each pair sign all the vertices.

Propositions 1.1. Possibilities for ***deep identifications***:

P1.1.1. Using complementary pair signs dnq_{ij}^{m} of the ***high degree m pair graphs*** g_{ij}^{m}**.** We call it ***high identification.***

Comment: For example, second degree pair graph $g_{ij}^{m=2}$ is this, which remain between vertices i and j of G after removing the preliminary pair graph g_{ij}, i.e. $g_{ij}^{m=2} = G \setminus [g_{ij} \setminus (v_i \& v_j)]$.

P1.1.2. Using complementary pair signs of the ***local semiotic model*** $\mathbf{SM}_{ij}$ of first or high degree ***pair graphs*** g_{ij}. We call it ***local identification.***

P1.1.3. Using complementary pair signs of the ***semiotic model*** $\mathbf{SM}_p$ of a ***sign graph*** G_p. Such deep identification mode we call ***sign graph identification.***

P1.1.3. Using complementary pair of the ***product of adjacency matrix*** $E\times E\times E\times\ldots=E^n$ where up to certain degree n the ***values*** of elements e^{n}_{ij} as well as the number p of their ***differences*** become larger, and then make a halt. We call it ***product identification (PIA).***

Conclusions 1.1. On the deep identification:

- **a)** To ***main characteristics*** remain after all the first degree pair signs $\pm d.n.q_{ij}$, the complementary deep signs have only a ***adjustable role***.
- **b)** Adjusted pair sign constitute quintuplet $\pm d.n.q.e^{n}_{ij}$, where to basic pair sign add a complementary**.**

All these possibilities are used in practice (see Examples 3.2, 3.5, 3.6).

Example 1.7. Result of product identification ***PIA*****:** The product $E\text{x}E\text{x}E=E^3$ of adjacency matrices and adequacy of semiotic and productive pair signs of a transitive graph**:**

Semiotic pair signs	*0*	*-2.6.11*	***+2.5.8***	***+2.4.5***	***+2.4.6***
Productive pair signs e_{ij}^{3}	*12*	*13*	**16**	**18**	**19**

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**=i**	u_i=12**345**	***k***
12	**18**	**16**	*13*	**19**	*13*	**16**	**18**	1	12**221**	**1**
18	*12*	**18**	**16**	*13*	**19**	*13*	**16**	2	12**221**	**1**
16	**18**	*12*	**18**	**16**	*13*	**19**	*13*	3	12**221**	**1**
13	**16**	**18**	*12*	**18**	**16**	*13*	**19**	4	12**221**	**1**
19	*13*	**16**	**18**	*12*	**18**	**16**	*13*	5	12**221**	**1**
13	**19**	*13*	**16**	**18**	*12*	**18**	**16**	6	12**221**	**1**
16	*13*	**19**	*13*	**16**	**18**	*12*	**18**	7	12**221**	**1**
18	**16**	*13*	**19**	*13*	**16**	**18**	*12*	8	12**221**	**1**

Comments: **a)** In present case attain the complete identify only on the third degree e_{ij}^3. **b)** Productive pair signs no contain direct structural data, but it is assert that these characterize the ***longest paths between vertex pairs***, which are in like manner also ***pair graphs***.

Semiotic and deep identification are inseparable, but to operate with deep semiotic model **SM** only then if it something concretize (see Examples 3.2, 3.5). As semiotics is grounded on the signs and their systems, then can also the multiplicative signs to semiotic call.

Simplification

We had afore shown rather symmetric graphs. For all the graphs generally be valid follow proposition.

Proposition 1.2. Almost all the graphs are ***0-symmetric, connected*** and with ***diameter 2.***

This means, that each vertex and vertex pair constitute a single position in structure. Be lacking any symmetry, the number of pair signs is very large. For solving applicative tasks is necessity to find some ***"similarity"*** between elements.

Example 1.8. Semiotic model of a *(degree)**regular*** but ***0-symmetric*** graph ***Z***.

A:-2.6.10; B:-2.6.9; C:-2.5.8; D:-2.5.7; E:-2.5.6; F:-2.4.5; G:-2.4.4;
H: +2.3.3; I: +2.4.5; J: +2.5.7; K: +3.10.25.

6	1	4	8	3	2	9	10	5	7	*i*	A	B	C	D	E	F	G	H	I	J	K	Pos1	abcde	Pos2
0	G	**I**	**J**	D	F	**I**	E	**I**	**H**	6	0	0	0	1	1	1	1	**1**	**3**	**1**	**0**	1	02250	1
	0	**H**	G	**J**	**I**	D	**I**	D	**I**	1	0	0	0	2	0	0	2	**1**	**3**	**1**	**0**	2	02250	1
		0	C	**I**	D	**H**	E	**I**	D	4	0	0	1	2	1	0	0	**2**	**3**	**0**	**0**	3	03050	2
			0	E	**H**	**I**	B	**H**	**H**	8	0	1	1	0	1	0	1	**3**	**1**	**1**	**0**	4	12150	3
				0	**H**	G	A	**H**	**H**	3	1	0	0	1	1	0	1	**3**	**1**	**1**	**0**	5	12150	3
					0	**I**	**I**	E	A	2	1	0	0	1	1	1	0	**2**	**3**	**0**	**0**	6	12150	3
						0	**H**	A	D	9	1	0	0	2	0	0	1	**2**	**3**	**0**	**0**	7	12150	3
							0	**K**	**H**	10	1	1	0	0	2	0	0	**2**	**2**	**0**	**1**	8	22041	4
								0	B	5	1	1	0	1	1	0	0	**2**	**2**	**0**	**1**	9	22041	4
									0	7	1	1	0	2	0	0	0	**4**	**1**	**0**	**0**	10	22050	5

Ten vertices of ***Z*** constitute each a single position. To finding the "similarities" can be use the ***approximated, rounded pair signs.*** In this case may be, for example:

$a{:}(A, B) \approx -2.6$, $b{:}(C, D, F) \approx -2.5$, $c{:}(F, G) \approx -2.4$, $\mathbf{d{:}(H, I, J) \approx +2}$ and $\mathbf{e{:}K \approx +3}$.

and

Instead of ten positions (*Pos1*) we get five (*Pos2*): (1, 6), (4), (2, 3, 8, 9), (5, 10) and (7).

Conclusion 1.2. This does not mean that the semiotic model of an object now formed on the basis of approximated pair signs. The right is to e***xamine the distribution of perfect pair signs and frequency vectors and on this basis to decide the issue of rounding.*** This make possible to understand what the "pseudo-positions" constitute.

Next chapter: 2. Semiotic model as text of structure