CONTRIBUTIONS TO THE DEVELOPMENT OF A SELECTION METHOD OF EQUIPMENT IN THE FRAME OF MECHANIZED MINING COMPLEXES

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***Abstract**: The paper intends to introduce a mathematical and a graph theory in the long wall mechanized face in order to take into account as much as possible all geologic-mining condition, for growing the productivity.*

***Key words**: mechanized face, correlation, systemic approach, mining conditions.*

1. INTRODUCTION.

The “mechanized face” system will work in certain geologic-mining conditions. However, the analyze of these conditions is not limited to the establishing some concrete values for identified factors of influence, because this values would correspond only for a certain face field and in a certain position of the face line on the surface of this field. Moreover, even in the framework of the same face field, the factors of influence can record variations.

2. THE USE OF THE SYSTEMIC APPROACH IN THE MECHANIZED FACE.

In the systemic approach of the issue of optimization for each factor described by a variable (which characterizes the geologic-mining conditions in which the “mechanized face” system will “work”) many values or many sub-fields should be foreseen according to the admissible variation for each variable.

For exemplification, the following factors of influence, described by the codified variables, will be taken into consideration, thus:

01- worked off layer thickness ;

02- layer slope ;

03- variation of the face level;

04- angle of raising/descending in the mining face advancing;

05- strength of the coal cutting;

06- coal hardness coefficient;

07- strength of the bottom compression;

08- strength of the roof compression.

A mechanized face will work in a certain period of time, in certain concrete conditions settled by a range of values of the above mentioned variables.

The design solutions (types of the face equipments for mechanization of the main operation complexes) that finally will define a mechanized face will have to be correlated with the geologic-mining conditions the mechanized face will work and that were previously described by the means of the stimuli-type variables.

The description of the technological solutions is made by a set of category -type checkable variables by which the type of the equipment used at every operation complex is defined. Each variable regarding the type of equipment will have as much qualitative values as different types of the respective equipment can be taken into consideration as being applicable in the given conditions.

For instance, we will note with A - the set of the face equipments, finite set.

$$A = \{a_1, a_2, ..., a_j, ..., a_k\} \quad (1)$$

a_j, $j = \overline{1,k}$ - is part of the A set and it is identified by the concrete type of equipment (respectively face shearer - in the given example).

In order to analyze the compatibility between the concrete geo-mining conditions in which the mechanized face and the equipment (face shearer) proposed to enter in the mechanized complex will work, that is, for short, for analyzing the conditions-solutions (C-S) compatibility it will be proceeded thus:

Be U- a certain set and A a finite subset of U, expressed as above.

Using a fuzzy function we can establish which is the a_j element (the equipment that could "enter" in the mechanized face complex) which will meet the best the needs of the concrete geologic-mining conditions (and in which will work the future mechanized face) defined by stimuli variables and for that those F_I fuzzy functions were built. Analogously, it can be analyzed the opportunity of using the other equipment types (for example B-mechanized supporting; C-face conveyors) with that the face shearer could work in the mechanized complex in the same concrete geologic-mining conditions.

It will be taken into consideration (discussion) all the elements $a \in A$, $b \in B$, $c \in C$, for which $\mu_{nF}(a)>0.5$, $\mu_{nF}(b)>0.5$,$\mu_{nF}(c)>0.5$, considering that the elements for that $\mu_{nF}>5$, belong in an important extent to F, unlike those for that $\mu_{nF}(a)<5$; which are considered to belong in a less important extent to F.

After drawing up all the "C-S" affiliation matrixes (for all the type of equipments which are eligible for setting up together an equipment complex), are analyzed the compatibility between every equipment belonging to the above mentioned equipments range in order to set up the mechanized face complexes able to work in concrete geologic-mining conditions.

For this it is appealing to the compatibility matrix (S-S) on concrete given conditions.

The fuzzyficated compatibility "solutions-solutions" (S-S) matrix for the concrete conditions (fig.1)

Machine	Type	Subset	Element	Affiliation degree	09	10	11						
					01	02	03	01	02	03	01	02	03
Shearer	1K101	09	01	μ_{01}^{09}				1		1	1		
	.		02	μ_{02}^{09}					1			1	1
	.		03	μ_{03}^{09}				1					
Mechanized supporting	.	10	01	μ_{01}^{10}							1		1
	.		02	μ_{02}^{10}								1	
	.		03	μ_{03}^{10}							1		
Conveyor	.	11	01	μ_{01}^{11}									
	.		02	μ_{02}^{11}									
	.		03	μ_{03}^{11}									

Figure 1.

The fuzzyficated “solutions-solutions” (S-S) compatibility matrix for the concrete conditions includes the figure “1” that certifies the compatibility between the “row” and “column” element and, respectively the figure “0” (or it can be omitted) which codes the incompatibility between the “row” and “column” elements being taken into consideration. Also, the compatibility (S-S) matrix includes an extra column given the classical compatibility (S-S) matrix, named column of affiliation degree. The numerical values of this column quantifies the affiliation degree of each element of the solutions sub-sets (for each equipment belonging to the types of equipments eligible for setting up a mechanized complex) for the concrete geological-minig conditions, conditions defined by the elements belonging to the “conditions” sub-sets.

Therefore, due to this matrix, the compatibility between different types of equipments that can enter in the mechanized face complex can be analyzed.

This matrix includes all the applicable variants. The possible applicable variants can be identified due to the fuzzyficated compatibility “S-S” matrix, or by hand proceedings using the successions graph (drew up by the means of modules from the diagonal), or by computer programmed algorithms.

The succession graph will have a special aspect, every element of the graph (every joint) will have attached a joint constant, named affiliation constant, which will define the compatibility of the respective type of equipment with concrete deposit conditions in which the issue of designing of the mechanized face complex is analyzed.

For the given situation (a hypothetical example) the succession graph will be as in figure 2.

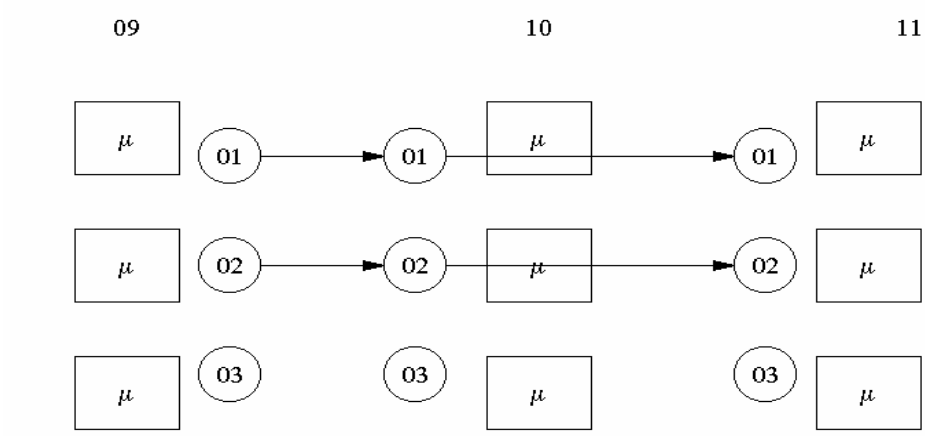

Figure 2.

3. CONCLUSIONS

In the next analyze stage, the variants generated by the "S-S" matrix will have to be assessed. The assessment of the variants will be made in the accordance with the type of functions that have to be assessed by the ways of succession graph (for example the price of the tone per face).

Therefore, at the end a series of technological variants have resulted, their assessment in order to need the criterion of proposed optimization will have to take into account this array of affiliation degree.

So, by applying the concept of vague sets (by fuzzyfication), the issues to be solved become more flexible and allowthose who have to take a decision to get many variants for the objectively established functions among them can select the best variant, in accordance with the requirements of the moment and intuition.

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