

Compatibility Between TRIZ Contradiction Matrix and LT-Units System

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The contradiction matrix is the most popular tool of the Theory of Inventive Problem Solving (TIPS, rus. TRIZ). It consists of 39 engineering parameters and 40 principles. Intersecting a parameter that is improving with one that is deteriorating automatically produces a technical contradiction (TC) that is successfully overcome if an adequate TRIZ principle is used. The same result can be obtained if two parameters are displayed in the space-time (LT) system as units whose multiplication (conjugation) produces the product in the form of a new LT-unit leading to an ideal final solution (IFS) of TC. It was found that 18 of the 39 TRIZ parameters can be represented as basic LT units, while the remaining 21 TRIZ parameters and all 40 TRIZ principles represent complex state expressions. The paper demonstrates the existence of synergies in finding an inventive problem IFS more effectively if both methodologies are used simultaneously.

Keywords: contradiction matrix, TRIZ parameters, LT-system.

1. INTRODUCTION

Out of 400,000 patents Altshuller analyzed, he singled out only 10% with the inventive steps [1], that is, the incorporated engineering system (ES) development laws [2]. Based on this discovery, he built a set of tools he called Theory of Inventive Problem Solving (TIPS, rus. TRIZ). The contradiction matrix is the most famous and simplest TRIZ tool [3]. It is made up of 39 basic parameters that can be used to describe any ES. When one wishes to improve a parameter, it automatically causes the other parameter, which is associated with it, to worsen. This correlation of the two parameters produces technical contradiction (TC), which is the essence of the problem. The innovator needs to recognize the feature he wants to improve on his ES as one of 39 standardized TRIZ parameters. If the innovator's parameter is not identical to any of the 39 TRIZ parameters, he considers the closest TRIZ parameter that corresponds to its essence and continues with it. He does the same thing when it comes to identifying a defective parameter. In order to overcome a TC in most other methodologies, system optimization is performed. However, TRIZ strives to overcome every problem by achieving the Ideal Final Solution (IFS) [3-5]. In case of applying the Contradiction Matrix, by intersecting the parameters that are being improved with those that deteriorate automatically, it is proposed in the cells of the matrix to use several different TRIZ principles out of a total of 40 defined, the application of which would most probably resolve the TC. This way, over 1200 different TCs that exist in ES can be solved [6]. The TRIZ principles in the cells of the contradiction matrix are listed in the

order that most likely lead to a solution of a problem, and they have been obtained through the statistical study of patents that had the same TC at the root of their problem. If, nevertheless, a solution is not found, then it is suggested that it be resolved by going through all 40 TRIZ principles [7, 8]. If all TRIZ principles are completely inapplicable, then the TC should be reformulated so as to reach an acceptable concept for a new lookout towards the solution of the problem. This confirms the insufficient effectiveness of the contradiction matrix and the need for its modification. This is supported by the fact that it has been more than 6 decades since the matrix was first disclosed. During this period science, technics and technology advanced significantly. Aware of this fact, Altshuller himself suggested that the matrix must be upgraded in line with changes in science and technology that will follow in the future. Due to the above facts, some authors tried to create modified versions of the contradiction matrix, adapting them to various fields of creativity (economics, business, management, pedagogy, chemical technology, etc.) [2, 6-8]. Improvements in the contradiction matrix were also attempted by adding or subtracting the number of rows or columns of the matrix, changing the name of the 39 technical parameters, adding new cells to the matrix or filling in the "empty" matrix cells, adjusting the matrix to the user based on some personal experience, using various mathematical models that would lead to the random selection of matrix cells, etc. [9-11]. Although such attempts were made with the best of intentions, they did not contribute to a significant improvement in the effectiveness of the adversarial matrix. The matrix cannot guarantee the solution of a complex technical problem without its deeper analysis. For matrix users, it is therefore recommended to formulate several TCs for a single problem situation, that is, to formulate a set of recommended principles. Proper implementation of the matrix means that a solution to a technical problem should be sought when the principles

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are “recommended” more than 3 times during the analysis of a problem situation, and the principle recommended only once should be ignored. In any case, this approach helps to understand and document a number of basic TCs in a system that can be of great importance for problem analysis. One of the main weaknesses of the matrix, but also of TRIZ as a whole, is that it represents a heuristic methodology, based on empirical knowledge and logical-descriptive methodology [12, 13]. This contributes to increasing the share of subjectivity in finding solutions to problems. However, the ideal solution can be only one, independent of the author trying to define it, and therefore it should be defined with mathematical precision. Applying a space-time (LT) - system of physical units can reduce subjectivity in the decision-making process. Likewise, it is possible to accurately describe not only engineering parameters and principles, but also economic, environmental, biological, chemical, etc. using the LT system [14]. Multiplying the two LT sizes produces a product in the form of a new LT size that provides "both this and that", which is similar to solving a TC in a TRIZ contradiction matrix.

2. LT- UNITS SYSTEM

Maxwell wrote about the possibility of creating systems of units of measure based only on length (L) and time (T) as far back as 1873, relying on Kepler's 3rd law and Newton's 2nd law [20]. If the rotation of the Earth and its inhomogeneity, as well as the deviation from the regular spherical shape, is neglected, the weight (F) of an object of mass (m) on or near the Earth's surface is equal to the gravitational force:

$$F=G (m_1m_2/r^2) \quad (1)$$

where F is force (body weight), G-gravity constant (dimensionless) which equals 1, m₁-mass of body 1, m₂--mass of body 2 on the Earth's surface, r²-distance between the center of the bodies, or:

$$F=m_1a=m_1m_2/r^2 \quad (2)$$

where m is the mass of the body on the Earth's surface, and the acceleration a = G (m₂/r²), where a is the acceleration of the Earth's gravity on its surface, which decreases with increasing body distance from the Earth. The force of the Earth's gravity (gravitational pull by the Earth) acts on the body, and the weight of the body acts on the substrate (or other body). Therefore, the mass dimension (m₂) is defined as the product of the acceleration dimension (LT⁻²) and the dimension of the spatial expansion square (L²). As a result, the dimension of mass in the LT dimension table looks like this:

$$[M]=L^3T^{-2} \quad (3)$$

This value uniquely determines the mass of the Sun, or it can be otherwise said that it is determined by it. For the mathematical representation of operations with the combination of different physical properties, a comparative system of kinematic quantities according to [21] and an SI system of physical quantities (Table 1) can be compared. It turns out that the interconnectedness of

physical quantities does not depend on the system in which they were given [13, 22-24].

Table 1. Important physical units and their characteristics in SI and LT physical units systems

No.	Physical unit name	Symbol or formula	Measure unit	Dimensions	
				SI	LT
1	Length	l	m	L	L
2	Time	t	s	T	T
3	Speed	v	m/s	LT ⁻¹	LT ⁻¹
4	Acceleration	a	m/s ²	LT ⁻²	LT ⁻²
5	Frequency	f	Hertz (Hz)	T ⁻¹	T ⁻¹
6	Mass	m	kg	M	L ³ T ⁻²
7	Force	F=ma	Newton (N)	MLT ⁻²	L ⁴ T ⁻⁴
8	Pressure, Strain	P=F/s= W/V	Pascal (Pa)	ML ⁻¹ T ⁻²	L ² T ⁻⁴
9	Energy, Work, Heat quantity	W=FI	Joule (J)	ML ² T ⁻²	L ⁵ T ⁻⁴
10	Force, Radiation flux	N=W/t	Watt (W)	ML ² T ⁻³	L ⁵ T ⁻⁵
11	Surface	S	m ²	L ²	L ²
12	Volume	V	m ³	L ³	L ³
14	Density	ρ _m	kg/m ³	ML ⁻³	T ⁻²
15	Impulse	P=mv	kgm/s	MLT ⁻¹	L ⁴ T ⁻³
16	Surface voltage	F=F/I= W/S	H/m	MT ⁻²	L ³ T ⁻⁴

This mindset is not loaded with psychological inertia. In studying the system of physical quantities, it illustrates the principles of the holistic structure of nature, according to which all individual parts belong to one whole, as each whole contains within itself all the characteristics of its constituent parts. A vision of the whole system and an understanding of the formal patterns in the relationships that exist between physical quantities make it easier to discover new laws of nature. Bartini [21] observed the regular relationships between physical constants and presented them in the form of a kinematic system of physical quantities, and together with Kuznetsov developed a geometric direction in the study of physical dimensions [25]. It is intuitively clear that an LT physical size chart could have significant practical value for innovators. However, they did not leave information on its possible practical application, nor did they in any way associate it with TRIZ. If you look at Table 2, it is observed that the vertical columns of the kinematic system contain a series of whole degrees of length (from L⁻² to L⁶) and the horizontal rows contain a series of integers of degrees of time (from T⁻⁶ to T³) [26]. The intersection of each column and each row gives a dimension of a certain physical size. The dimensions of all physical quantities are represented as a product of the whole degree, LⁿT^m, where |n + m| ≤ 3 for three-dimensional space. Table 2. expresses the physical laws of conservation.

Table 2. TRIZ parameters in the LT Table - System of Physical Units (length [L] and time [T])

Valu- es	L^{-2}	L^{-1}	L^0	L^1	L^2	L^3	L^4	L^5	L^6
T^6						L^3T^{-6}	L^4T^{-6}	L^5T^{-6}	
T^5					L^2T^{-5}	• Surface power	L^4T^{-5}	Power 21	19
T^4				• Specific gravity • Gradient of pressure	• Pressure • Tension 11	• Surface • Tension • Rigidity	Force 10; 27	• Force momentum • Energy • Statistical temperature 17	
T^3			L^0T^{-3}	Current density	• Electro-magnetic i.e. Field Strength • Ductility	• Current • Loss mass	• Motion quantity • Impulse 1	• Angular momentum • Action	
T^2			• Mass density • Angular acceleration	• Magnetic displacement • Acceleration	Potential difference	• Mass • Quantity of magnetism or electricity 2	Magnetic momentum	Moment of inertia	
T^1		Volume charge density	Frequency	Velocity 9	• Twodi-mensional abundance • Velocity of change of the area 3	Loss volume 5; 23	L^4T^{-1} 7		
T^0	$L^{-2}T^0$	• Crookedness • Change of conductivity	Dimensionless constants (for example, a radian)	• Length • Capacity • Selfinduction 4; 15	Surface 6	Volume of space 8			
T^1	Changing of magnetic permeability	Conductivity	Period, Duration 16	Time necessary for change of length on unit	L^2T^{-1}	L^3T^{-1}			
T^2	Magnetic permeab.	$L^{-1}T^2$	Surface of time	L^1T^2	L^2T^2				
T^3	$L^{-2}T^3$	$L^{-1}T^3$	Volume of time	L^1T^3					

For example, by equating the dimension of a cell L^1T^0 to a constant, one obtains the law of conservation of the length of a solid: $L = \text{const}$. Equation $L^{+5}T^{-4} = \text{const}$. gives the energy conservation law. Equation $L^{+2}T^{-4} = \text{const}$. reflects Hooke's law. Equation $L^{+3}T^{-2} = \text{const}$. is Kepler's law (the ratio of planetary cubic radius and square of rotation is constant). A very important and useful feature of Bartini's table is that each cell, or a corresponding law it contains, has a certain volume of object grouped into classes. Indeed, many cells contain not just one physical size, but several. For example, there are two physical quantities in cell $L^{+3}T^{-2}$: mass and amount of charge, in cell $L^{+1}T^0$ there are three quantities: length, capacitance, self-induction, etc. Moreover, many cells can be added even though they are not listed in Bartini's physical size chart. For example, in the SI system, thermal conductivity is measured in $[W/m \cdot K]$.

If the power dimension $L^{+5}T^{-5}$ is put in place of Watt and instead of Kelvin the temperature dimension $L^{+5}T^{-4}$, then thermal conductivity must be added to the cell with dimension $L^{-1}T^{-1}$. According to the SI system, the mass flow rate is measured in $[kg/s]$. If the dimension kilogram is replaced by the force $L^{+4}T^{-4}$, then the value $L^{+4}T^{-5}$ is obtained. As you can see, in the original table, this size is not so specified. Since there is no kilogram - force in the dimension $[kg/s]$, but there is a kilogram - mass, then $L^{+3}T^{-3}$ is obtained. The strength of classification is that each class contains an "invariant" property, i.e., a property that is represented in all elements of this class. Kuznetsov calls this object an entity or essence. What is the invariance or essence of length, capacity, and self-induction for an innovator in his inventive tasks? The fact is that they all have the same physical dimension $L^{+1}T^0$. Therefore, when there are

length, capacity, or self-induction properties in an inventive problem, these properties can be operationally utilized by the same methods. The same is true of something similar to what is called the "similarity criterion", when conservation laws are different in different fields of physics and have the same mathematical structure. For example, if in mechanics there is (in any formula) length expressed by square meter, then in a similar formula for electricity, capacity will also be expressed by squared symbol.

Bartini's table can be used to solve inventive problems at the physical level, i.e., in the case of physical contradiction (PC) formulation and solution, because it contains physical units, which characterize the spatial-temporal and sub-field (substance + field) resources in the problem.

Table 3. comprises all 39 TRIZ parameters that have been classified according to LT-units system. A detailed description of every individual TRIZ parameter is given in the literature [9, 11, 27].

Table 3. 39 TRIZ engineering parameters in LT-system

No.	Title	LT- value
1	Weight of moving object	L^4T^{-3}
2	Weight of stationary object	L^3T^{-2}
3	Length of moving object	L^2T^{-1}
4	Length of stationary object	L^1T^0
5	Area of moving object	L^3T^{-1}
6	Area of stationary object	L^2T^0
7	Volume of moving object	L^4T^{-1}
8	Volume of stationary object	L^3T^0
9	Speed	L^1T^{-1}
10	Force	L^4T^{-4}
11	Stress or pressure	L^2T^{-4}
12	Shape	Condition expression
13	Stability of the object's composition	Condition expression
14	Strength	Condition expression
15	Duration of action by a moving object	L^1T^0
16	Duration of action by a stationary object	L^0T^1
17	Temperature	L^5T^{-4}
18	Illumination intensity	Condition expression
19	Use of energy by moving object	L^6T^{-5}
20	Use of energy by stationary object	Condition expression
21	Power	L^3T^{-5}
22	Loss of Energy	Condition expression
23	Loss of substance	L^3T^{-1}
24	Loss of Information	Condition expression
25	Loss of Time	Condition expression
26	Quantity of substance/the matter	Condition expression
27	Reliability	L^4T^{-4}
28	Measurement accuracy	Condition expression
29	Manufacturing precision	Condition expression
30	External harm affects the object	Condition expression
31	Object-generated harmful factors	Condition expression
32	Ease of manufacture	Condition expression
33	Ease of operation	Condition expression
34	Ease of repair	Condition expression
35	Adaptability or versatility	Condition expression
36	Device complexity	Condition expression
37	Difficulty of detecting and measuring	Condition expression
38	Extent of automation	Condition expression
39	Productivity	Condition expression

Bartini's LT - table can easily find TRIZ parameters classified as basic physical units (1-11, 15-17, 19, 21, 23 and 27). However, other TRIZ parameters, which are classified as condition expressions, cannot be found in the LT - table. They can be reached through mathematical and physical unless you know the value of TRIZ parameters displayed as LT - size, then multiplication or division two known values identify an unknown parameter or TRIZ parameter or TRIZ principle as condition expression. Cause-and-consequence analysis can make a transition from a state expression to a basic LT-parameter in each particular case.

When combining the use of TRIZ's contradiction matrix and LT table, the basic and derived physical units have a convincingly high frequency of occurrence, i.e., extremely large number of repetitions of one LT - unit, while in the expression of state there are more LT - units that have the same frequency of occurrence. That's logical. For example, the TRIZ parameter no. 12 "shape" is a condition expression. In aerodynamics, it could be reduced to basic physical unit (resistance to airflow), but in the case of the shape of the chair made for sitting, ergonomics and comfort are important, i.e., width and height or something similar, and not resistance. By searching for a reason for this, a cause and effect analysis might lead to a completely different basic parameter from resistance. So, in the case of shape, there are multiple LT-units of equal importance i.e., frequency, because it is a complex expression of a condition. Likewise, each of the 40 TRIZ principles has multiple LT - units of equal frequency of occurrence, which only confirms the fact that the principles are also expressions of condition.

3. A CASE STUDY

The Filtering Protective Suit (FPS) is a filtering means that protects user's body from high toxic materials (HTM) [4]. This paper deals with experiments that were conducted to test the basic physical and mechanical characteristics of FPS-M1-M3 (manufactured by "Trayal Korporacija", Krusevac, Serbia) and FPS-M4 (manufactured by "Proizvodnja Mile Dragić", Zrenjanin, Serbia). Materials used in experiments had the following properties:

- FPS-M1 untreated, the inner layer is double cotton gauze impregnated with activated carbon powder and reinforced with a polyamide fabric;
- FPS-M2 untreated, the outer layer material is oleophobic and hydrophobic textile material based on a mixture of cotton-polyester; the inner layer material is a powder of activated carbon impregnated with polyurethane foam (PUF) and sandwich two light fabrics;
- FPS-M3 untreated, the outer layer is an oleophobic and hydrophobic textile material based on a mixture of cotton-polyester; the material of the inner layer is the spheres of the active carbon material (ACM) glued to the fabric and covered with another fabric;
- FPS-M4 untreated, the outer layer material is an oleophobic and hydrophobic textile material based on a mixture of cotton-polyester; the material of the inner layer is ACM glued to the fabric and covered with another fabric.

FPS was tested for the raw materials, surface mass, thickness, breaking forces, intermittent elongation and ripping forces. Air permeability and water vapor tests were also performed to test the basic functional characteristics of the FPS. The protective power of FPS against HTM was tested using a sophisticated dynamic gas chromatographic method, and the protection time for the effect of HTM drops was determined using S-yperte in dynamic working conditions. The testing of the heat transfer process through various materials embedded in the FPS was carried out in laboratory and field conditions. The appropriate anthropometric and ergometric indicators and measured thermoregulation characteristics were tested as well. This made it possible to compare the materials according to all the relevant thermo-regulation parameters of the body.

4. RESULTS AND DISCUSSION

Results have shown that protective suits FPS-M3 and FPS-M4 present a significant improvement compared to domestic FPS of previous generations: FPS-M1 and FPS-M2. Both FPS models are on the level of modern means of personal percutane protection when all the examined characteristics are taken into account. Testing of the protective properties of FPS against the effects of HTS was conducted by the total process of penetration of S-yperte vapours through their materials. During hours of examination, in all models of FPS, output contamination density did not reach the value of $4 \mu\text{g}/\text{cm}^2$, which fulfilled the set request from standards [4]. Comparison of FPS-M3 and FPS-M4, in terms of surface mass of outer and inner layer, shows that FPS-M4 has $30 \text{ g}/\text{m}^2$ greater surface mass and $80 \text{ g}/\text{m}^2$ of the inner layer. This means that the total surface mass of FPS-M3 is smaller by $\approx 110 \text{ g}/\text{m}^2$ compared to FPS-M4. Considering that for production of a set of FPS, 5 m^2 to 6 m^2 of material is required, FPS-M3 is of a smaller mass than FPS-M4 by 550 to 600 g. Difference in mass of FPS can represent an important factor for choosing FPS model when equipping an army. However, from a practical point of view, it is necessary to determine values of key parameters that are important for calculating the IFS. The highest ponder belongs to the heart frequency as the most important physiological parameter which directly impacts the safety (life) of the user, followed by surface mass, wearing comfort and price [4]. FPS-M3 model reached ideality of 69.98%, and model FPS-M4 - 66.01%. This result is surprising, in a way, considering that FPS-M4 average heart frequency, comfort and price were better compared to FPS-M3. Applying the methods of optimization of the listed parameters, FPS-M4 was chosen as an overly better means. However, applying the formula for calculating ideality showed that the difference in mass, as an unwanted parameter, was so much better for the FPS-M3 that this parameter was the prevailing factor in deciding the greater total ideality of this means [4]. Increasing ideality of both FPS models can be achieved by increasing their individual parameters. In the case of FPS-M3 the work is needed on constructional changes which would contribute to the lower value of heart frequency ($R=48.4\%$), and in case of FPS-M4 the work should be done on fixing the parameter of surface mass i.e. total

mass ($R=50.4\%$). It is called technical improvement or innovation of a lower inventiveness level [4]. The decision of transfer from evolutionary innovation (FPS-M1-4) to radical innovation (FPS-MX), has been reached when IFS was calculated to be 69.98% for FPS-M3.

The Butterfly algorithm can systematically find the solution strategy for the problem, and thus help solve contradictions efficiently [28]. The Butterfly diagram performs a visual role in analyzing physical contradictions and technical contradictions easily. By applying the propositional logic, the Butterfly algorithm derives the right direction efficiently and logically. TC1: If a FPS mass is small (a desirable characteristic), then protection from HTM is weak (undesirable characteristic). TC2: If protection from HTM with the help of FPS is good (desirable characteristic), then its mass is too big (undesirable characteristic). The Butterfly diagram contains the following logic:

$$(s \rightarrow w) \square (s \rightarrow u) \text{ and } (w \square u) \rightarrow (-s \square w) \quad (4)$$

A solution is sought after where FPS provides good protection (TC1) and it has a small mass (TC2). In this case there are two possible TC versions which contain conflicts: conflict 1 – intention to eliminate or decrease the harmful function leads to weakening of the useful function, and conflict 2– intention to improve a useful function leads to increase of the harmful function (Figure 1).

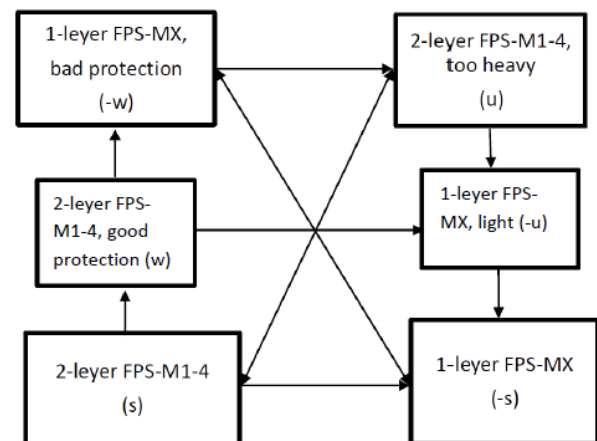


Figure 1. The Butterfly diagram for the FPS-MX problem

Legend: w is a wanted function of s; u is the unwanted function caused by satisfying a state s, which is a condition for supporting w; -s is a condition for supporting.

Table 4. The part of LT-innovation Matrix of Contradictions used for case analysis

	PARAMETERS (1-39)	Worsening	PRINCIPLES (1-40)	
		23 (L ³ T ⁻¹)	No./Name	LT-value
Improving	2 (L ³ T ⁻²)	5; 8; 13; 30	5/Consolidation 8/Counterweight 13/Equipotentiality 30/Flex. membranes	L ⁷ T ⁻⁴ L ⁶ T ⁻³ L ⁵ T ⁻² L ⁴ T ⁻¹

This means that the key parameter to be corrected is no. 2 (mass of the stationary object). If the mass of the stationary object decreases, the parameters no. 23 (loss

Table 5. Trend of sufield resources in the case of FPS-MX

Dim	L ⁻²	L ⁻¹	L ⁰	L ¹	L ²	L ³	L ⁴	L ⁵	L ⁶	L ⁷
T ⁻⁶	L ⁻² T ⁻⁶	L ⁻¹ T ⁻⁶	L ⁰ T ⁻⁶	L ¹ T ⁻⁶	L ² T ⁻⁶	L ³ T ⁻⁶	L ⁴ T ⁻⁶	L ⁵ T ⁻⁶	L ⁶ T ⁻⁶	L ⁷ T ⁻⁶
T ⁻⁵	L ⁻² T ⁻⁵	L ⁻¹ T ⁻⁵	L ⁰ T ⁻⁵	L ¹ T ⁻⁵	L ² T ⁻⁵	L ³ T ⁻⁵	L ⁴ T ⁻⁵	L ⁵ T ⁻⁵	L ⁶ T ⁻⁵	L ⁷ T ⁻⁵
T ⁻⁴	L ⁻² T ⁻⁴	L ⁻¹ T ⁻⁴	L ⁰ T ⁻⁴	L ¹ T ⁻⁴	L ² T ⁻⁴	L ³ T ⁻⁴	L ⁴ T ⁻⁴	L ⁵ T ⁻⁴	L ⁶ T ⁻⁴	L ⁷ T ⁻⁴
T ⁻³	L ⁻² T ⁻³	L ⁻¹ T ⁻³	L ⁰ T ⁻³	L ¹ T ⁻³	L ² T ⁻³	L ³ T ⁻³	L ⁴ T ⁻³	L ⁵ T ⁻³	L ⁶ T ⁻³	L ⁷ T ⁻³
T ⁻²	L ⁻² T ⁻²	L ⁻¹ T ⁻²	L ⁰ T ⁻²	L ¹ T ⁻²	L ² T ⁻²	L ³ T ⁻²	L ⁴ T ⁻²	L ⁵ T ⁻²	L ⁶ T ⁻²	L ⁷ T ⁻²
T ⁻¹	L ⁻² T ⁻¹	L ⁻¹ T ⁻¹	L ⁰ T ⁻¹	L ¹ T ⁻¹	L ² T ⁻¹	L ³ T ⁻¹	L ⁴ T ⁻¹	L ⁵ T ⁻¹	L ⁶ T ⁻¹	L ⁷ T ⁻¹
T ⁰	L ⁻² T ⁰	L ⁻¹ T ⁰	L ⁰ T ⁰	L ¹ T ⁰	L ² T ⁰	L ³ T ⁰	L ⁴ T ⁰	L ⁵ T ⁰	L ⁶ T ⁰	L ⁷ T ⁰
T ¹	L ⁻² T ¹	L ⁻¹ T ¹	L ⁰ T ¹	L ¹ T ¹	L ² T ¹	L ³ T ¹	L ⁴ T ¹	L ⁵ T ¹	L ⁶ T ¹	L ⁷ T ¹
T ²	L ⁻² T ²	L ⁻¹ T ²	L ⁰ T ²	L ¹ T ²	L ² T ²	L ³ T ²	L ⁴ T ²	L ⁵ T ²	L ⁶ T ²	L ⁷ T ²
T ³	L ⁻² T ³	L ⁻¹ T ³	L ⁰ T ³	L ¹ T ³	L ² T ³	L ³ T ³	L ⁴ T ³	L ⁵ T ³	L ⁶ T ³	L ⁷ T ³

of matter) worsen (Table 4). Thus there is contradiction TC (2x23). To overcome TC, use of the following principles 5; 8; 13 and 30. In this case, more promising solution is to eliminate the inner protective layer from the existing FPS system which is impregnated with spherical particles of activated carbon, and instead introduce a new TiO₂ compound. This substance is able to decontaminate HTM in the presence of sunlight [29]. The choice of self-contamination material of the external layer impregnated with nanoparticles of TiO₂ [30], or some other nanomaterial, presents a completely different conceptual approach to the development of FPS. The eco-innovative principle of the FPS-MX could be based on one of the two possible solutions: using a cooling system, using a temperature sensor or impregnating the outer layer of the FPS fabric with TiO₂. Of course, the application of TiO₂ is closer to the concept of ideality. Namely, in view of the previous preliminary investigations carried out [29-31], it has been found that textile substrates are being created by modification of the standard military textile with TiO₂ nano-particles, and that those substrates have a property of self-decontamination under certain experimental conditions.

A similar solution of a TC in this case can occur if the LT system is implemented. The dimensional LT basis of the Bartini-Kuznetsov method is based on invariants that do not differ in coordinate transformation. Invariants define relations of physical constants and therefore represent hereditary memory for physical laws. This memory is transmitted through the trends of spatial (L), temporal (T) and so-called development. additional resources (diagonals in the LT table). Finding resources to find a solution for the TC involves three stages: multiplying parameters by the logic of "both this and that".

Finding an inherited (genetic) trend is obtained on the diagonal of the obtained product of the two parameters that make up the TC and then a specific X-resource is selected on that genetic trend. The trend of LⁿT⁻ⁿ⁺³ includes the following units: L⁷T⁻⁴ (aggregation or surface transfer), L⁶T⁻³ (moment of action), L⁵T⁻² (power transport), L⁴T⁻¹ (mobile object volume), L³T⁰ (stationary volume) object etc. (Table 5). TRIZ principle no. 8 refers to a counterweight, which involves compensating for the weight of an object by using some available force from nature such as e.g. hydrodynamic forces, aerodynamic forces, etc. With FPS, this could mean that by ejecting the inner protective layer, the classic war uniform should be reactive in terms of HTM

protection. This can be achieved if the outer layer of the war uniform is impregnated with TiO₂ nanoparticles, which in contact with the sun's rays decontaminate the HTM molecules that reach the surface of the uniform. The described property is best suited to L⁶T⁻³ (torque).

5. CONCLUSION

The contradiction matrix as a tool of the Theory of Inventive Problem Solving (TRIZ) and the invariant spatio-temporal language given in the LT units system are two independent dialectical methodologies that serve to solve inventive problems. TRIZ is an empirical science based on the discovery of the laws of development of engineering systems contained in patent documents. The LT-system is basically a mathematical-physical system based on the axiom of equality of inertial and gravitational mass through the expression L³T⁻². In TRIZ, a starting point is an inductive inference, and in LT a deductive. As both systems dialectically seek out the IFS of the technical and physical contradictions that underline each problem, it is suggested that they be combined to minimize the individual shortcomings of both systems. The imprecision of the TRIZ contradiction matrix and the LT system's excessively high accuracy have been successfully reduced or completely eliminated as individual drawbacks of these methods, if combined and complemented when solving the same engineering problem.

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КОМПАТИБИЛНОСТ ИЗМЕЂУ ТРИЗ МАТРИЦЕ КОНТРАДИКТОРНОСТИ И ЛТ- СИСТЕМА

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Матрица контрадикторности је најпопуларнија алатка Теорије решавања инвентивних задатака (ТРИЗ). Она

се састоји од 39 инжењерских параметара и 40 принципа. Укрштањем параметра који се поправља с оним који се аутоматски квари, настаје техничка контрадикција (ТК) која се успешно превазилази уколико се употреби адекватан ТРИЗ принцип. До истог резултата може се доћи уколико се два параметра прикажу у просторно-временском (ЛТ) систему као физичке величине чијим множењем (коњугацијом) настаје продукт у виду нове ЛТ-величине која води ка идеалном коначном решењу (ИКР) ТК. Утврђено је да 18 од 39 ТРИЗ параметара могу да се прикажу као основне ЛТ-величине, док преосталих 21 ТРИЗ параметара и свих 40 ТРИЗ принципа представљају сложене изразе стања. У раду је доказано постојање синергизма у ефикаснијем проналажењу ИКР инвентивног проблема уколико се истовремено користе оба система.