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TECHNICAL ASPECTS OF PSYCHOPHYSICAL STATE SIMULATING OF MILITARY PERSONNEL IN EXTREME AND COMBAT SITUATIONS

Abstract. The **subject matter** of the article is the psychophysical state of a person in an extreme situation. The **goal** of the study is providing recommendations for the behavior of people in the conditions of instantaneous action of the excitation function and the subsequent transient process. **The tasks** to be solved are: to consider the mental and physical state of man, in terms of the basic principles of the theory of transients in electrical circuits and determine the analogy between the state of processes in storage in wildlife and technology and draw conclusions about the possibility of concretizing them mentally and physically; to apply the theoretical provisions of the theory of transients with two energy storage to model the psychophysical components of the human condition in extreme situations and combat situations; based on studies of the relationship between the human psychotype and the degree of inertia for behavior in transition and the assessment of possible time to its completion, to provide recommendations for human behavior, including military, in emergencies and combat situations. General scientific and special **methods** of scientific knowledge are used. The following **results** were obtained: an analogy has been made between the electromagnetic and psychophysical states of a person with the allocation of two-unit processes makes it possible to apply the theoretical provisions of the description of one kind (electromagnetic) to substantiate the behavior of other psychophysical constituents. The implementation of the results of this study allows for the general public with different theoretical background to find out the rules of behavior in difficult life situations. **Conclusions.** The psychophysical state of man includes a number of individual characteristics that are decisive and can be specified by mental and physical characteristics. Unconditional circumstances are the function of arousal and the subsequent transient process, the results of which have objective consequences, because they are due to the action of physical laws and do not depend on subjective desires. Understanding the analogy between the state of processes in wildlife storage and technology is necessary to take into account in everyday activities and, especially, in emergencies and hostilities. Active mental activity should be carried out during the responsible, anxious moments, the time of expectation, etc.: analysis of the situation, search for the best options for completing the task, poems, songs (religions usually recommend prayers). This will eliminate the possibility of losing control of the environment, eliminate the formation of panic, fear and negative mental phenomena. In any case, it is essential not to remain in a state of unconsciousness and apprehension, as the induced function will in this case lead to stupor and the impossibility of responding gracefully to the threat and taking a positive decision. The time of the transition process depends on the psychotype of the person and can be shortened by special training, experience and a conscious attitude towards autotraining.

Keywords: the psychophysical state of human beings, transient processes in electrical circuits, human psychotype, extreme, combat situations.

Introduction

Formulation of the problem and research tasks.

The existing threats to human life and health in an extreme situation that occurs for military personnel in the conduct of hostilities and in an extreme environment lead to the clarification of the conditions for losing control over conscious actions, which ultimately can lead to a failure to complete the task. due to a possible panic state. Human behavior in such difficult life situations is determined not only by its psychophysical properties, but also by overcoming the consequences caused by the actions of the excitation function of the transition process, as the transition from initial (initial) to forced (excited) mode.

By definition, the action of the excitation function at any time $t = 0$ (we believe that this is not expected for humans) for $t = 0$ (i.e., instantaneously), objectively leads to a transient process with consequences that can be described not only in the technical aspect, for example, in electrical engineering, but also, as will be shown in the work, for a person taking into account its psychomotor properties.

This indicates the **relevance** of addressing this issue to the impact of extreme processes on individuals, their actions, for example in a combat setting.

Analysis of recent research and publications.

The first publications on these topics appeared in the middle of the 19th century, when psychophysics was recognized as a separate branch of experimental psychology.

The main regular relations of two series of phenomena: mental and physical, were connected functionally by means of analytical dependencies.

Thus, the results of the conducted research were of a general nature and did not provide practical recommendations for applied fields, especially the military one. Further research was carried out mainly in the fields of philosophy, psychology, pedagogy and other humanistic sciences [1-4].

The **goal** of the study is providing recommendations for the behavior of people in the conditions of instantaneous action of the excitation function and the subsequent transient process

This goal defined the following research **tasks**:

– to consider the mental and physical state of man, in terms of the basic principles of the theory of transients in electrical circuits and determine the analogy between the state of processes in storage in wildlife and technology, draw conclusions about the possibility of concretizing them mentally and physically;

– to apply the theoretical provisions of the theory of transients with two energy storage to model the psychophysical components of the human condition in extreme situations and combat situations; based on studies of the relationship between the human psychotype and the degree of inertia for behavior in transition and the assessment of possible time to its completion,

– to provide recommendations for human behavior, including military, in emergencies and combat situations.

General scientific and special **methods** of scientific knowledge are used.

1. The mental and physical state of man, in terms of the basic principles of the theory of transients in electrical circuits

1.1 The theoretical basis of the matter is the theory of transient processes with two energy. The theoretical prerequisite for considering the issue is essentially the theory of transient processes with two energy storage devices (in electrical engineering, electric E and magnetic H energies) in the presence of a voltage excitation function.

In practice, by analogy with the well-known electromagnetic theory, one can consider the mental and physical states of a person, which, in general, can also be characterized by two drives. At the same time, the mental component is determined by the activity of the

brain, while the physical component is determined by the physical energy in the muscles.

Indeed, the human brain operates with information and is determined by the corresponding capacitance C_m . Therefore, in comparison, according to this property, it is advisable to correlate it with a capacitor of some electrical capacitance C_{el} . Then the inductance L_m as a characteristic of the accumulated magnetic energy is completely analogous to the concentration of physical energy L_f in human muscles.

1.2. Analogies of the electromagnetic and psychophysical state of a person. The concretization in the name with the separation of two-pronged processes makes it possible to apply the theoretical provisions of the description of one type (electromagnetic) to justify the behavior of other psychophysical components. Analogies of the electromagnetic and psychophysical state, summarized in table 1. As can be seen from the table, according to zero initial conditions, the absence of a capacitor charge is equivalent to the absence of current information in the brain. This type of storage at the time of the appearance of the excitation function is characterized by zero resistance, that is, they are shunted in the short circuit mode, similar to the resistance of a capacitive element (explanation in table 1). At the same time, accumulators of alternative energy (magnetic/physical) with zero initial conditions go into idle mode, which leads to their complete shutdown at the moment $t=0$ of the start of the transient process.

Table 1 – Analogy of state and processes in drives

In technology	In wildlife
The electromagnetic state of the circuit	The Psychophysical state of man
C_{el} – capacitance capacitor	C_m – capacity of information in the brain
L_m – accumulation of magnetic energy	L_f – accumulation of physical energy
Explanation and justification	
At the moment $t = 0$, the excitation function begins a specific transient process	
At the moment $t = 0$ the excitation function is perceived by the action of ultrahigh frequency $\omega \rightarrow \infty$	
Capacitive resistance $X_C = \frac{1}{\omega C} = \frac{1}{\infty C} \rightarrow 0$. That is, a short circuit (short circuit mode) of this element occurs, regardless of the parameter of the corresponding energy storage device. .	
The resistance (reactive) of the L-energy storage device is described as $X_L = \omega L = \infty L \rightarrow \infty$, at the first moment of the excitation function, the circuit element is idling, depending on the ownership and characteristics of these storage devices.	

Interpretation of the dependences known in electrical engineering is given in tables 2-4. Thus, in the first moment of switching capacitors, as electrical energy storage form short-circuited areas, and the inductors become broken in the circuit, which significantly modifies the whole circuit.

1.3. The first practical conclusion. For the psycho-physical state complete virginity of the brain and lack of physical movements - characterizes the complete exclusion of the ability to think and forces to remain motionless without the ability to escape. Indeed, in this case, the person loses a sense of reality, time, is in a stupor, and in terms of muscle function, there is numbness (during the transition process).

This process is extremely dangerous and therefore requires further study. because it is the first initial stage of panic.

1.4. Electromagnetic and psychophysical states with nonzero initial conditions. The law of conservation of energy in the presence of a capacitor charge (active brain) leads to the law of switching, according to which energy in the capacitance

$$W_c = \frac{CU^2}{2} \quad (1)$$

cannot change instantaneously during the excitation function, and therefore taking into account the first practical conclusion:

Table 2 – Electrical dependences in time


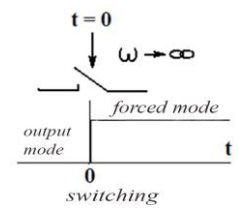

Capacitors	Definition resistance	Under the action of the excitation function	Equivalent state
 <p>$C, \mu F$</p>	$X_C = \frac{1}{\omega C};$ with $\omega \rightarrow \infty X_C = 0$		$X_C \rightarrow 0;$ Short-circuit mode regardless of the capacity C
Inductors	Designation	Excitation function in transition in $t = 0$ for $t = 0$ equivalent to the action of infinite frequency	$X_L \rightarrow 0;$ Idling mode regardless of the inductance L
 <p>L, H</p>	$X_L = \omega L;$ with $\omega \rightarrow \infty X_L = \infty$		

Table 3 – Brain activity during excitation function

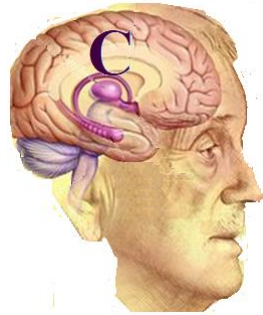

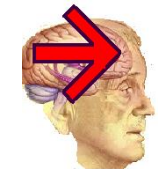
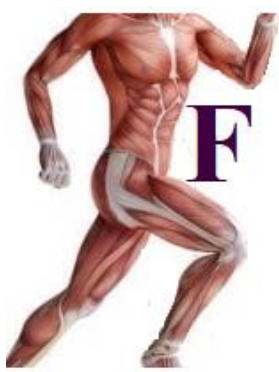


The memory amount C	The action of the excitation function	Brain information	The result of the excitation function
	$X_c = \frac{I}{\omega C};$ with $\omega \rightarrow \infty X_c \equiv 0$	$I = 0$	
		$I \neq 0$	

Table 4 – Muscle activity during excitation function

Force F in muscles	The action of the excitation function	Force in muscles	The result of the excitation function
	$X_L = \omega L;$ with $\omega \rightarrow \infty X_L = \infty$	$F = 0$	
		$F \neq 0$	

- any capacitive drive goes into short circuit mode;
 - this type of storage continues to contain charges (information) other than zero.

Therefore, capacitive C-accumulators, taking into account the preconditions, act as sources of the corresponding energy, generating previously accumulated charge/information.

The commutation law for L as an accumulative transmission, which has energy

$$W_c = \frac{LI^2}{2} \quad (2)$$

under behind the stream $I \neq 0$, so it cannot be changed, that means the follows:

- accumulating physical energy to switch to idle mode;

- at the same time, physical movement, similarly to stream I , takes its direct and significant value, so that it acts as a viable source of energy and continues to function [5, 6].

1.5. The second practical conclusion. For mental and physical conditions, when the brain and muscles are constantly engaged in work, even the exertion of the restlessness will not be able to disrupt the functioning of the muscles and the brain, allowing you to act with competence in extreme situations, keeping under control of the father, both in the execution of the task, and to ensure their own safety and life of their co-workers, blocking the spread of panic in people with zero basic conditions.

Such a commitment and understanding is important for both the experienced and the beginners in the military in emergency situations.

2. Transition processes in psycho-physical representation. Transition processes with two accumulators

The excitation function in the system of two drives, taking into account the processes at $t = 0$ for $t=0$ is (Fig. 1) a prerequisite for transferring the system from initial to forced (excited) state, which, in fact, determines the subsequent transition process.

The transition process is considered complete with an error of up to 1% after 4τ . Where τ is the measure of inertia in the measurement of time for the object / subject.

In practice, the time of the transition process is satisfied $t_{tr} = 3\tau$. The error does not exceed 3%. The latter allows you to estimate for the object, both the excitation time and the subsequent transition to the excited state.

In general, there are three types of transients, which are shown in Fig. 1, where

- 1 – aperiodic;
- 2 – is oscillating;
- 3 - critical modes.

The transition time is $t_{tr} = (3-4)\tau$.

It is known from the theoretical foundations of electrical engineering that the influence factor on the type of transient process is the active resistance of the circuit.

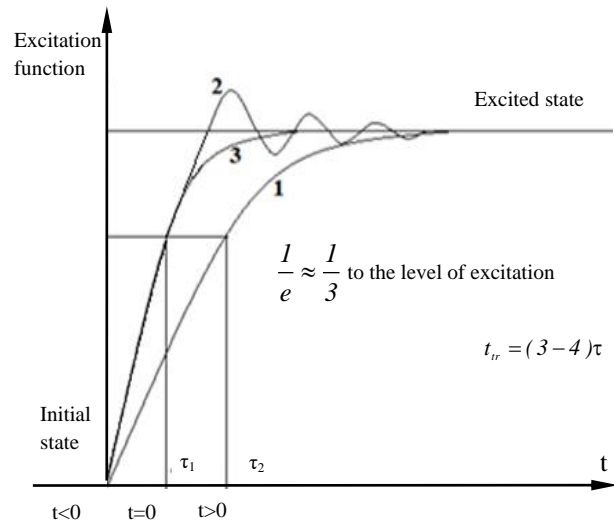


Fig. 1. Transients graphs:
 1 – aperiodic; 2 – vibrational; 3 – critical

In our case, the resistance of the object to the environment, which can be determined by human psychotype [7, 8].

3. The relationship between the human psychotype and the degree of inertia

In psychology, there are the following basic psychotypes of human nature:

– phlegmatic and melancholic characters indicate significant internal resistance to the environment, which is why such people are perceived as “inhibited”;

– people with cholesterol can be considered more efficient and balanced, and therefore they perceive the environment with the optimum resistance for this purpose;

- human - sanguine is characterized by a sharp, “no brakes” of character, which determines the low level of resistance to the environment.

These psychotypes of man, by analogy in technology, allow to match the measure τ of their inertia for behavior in the transition process, and thus to assess the possible time $t_{tr} = (3-4)\tau$ to its completion.

Thus, people of phlegmatic type of character after the corresponding reaction to the excitation function carry out aperiodic (Fig. 1 – 1) transition process.

The oscillating nature of the transition process is marked by people of sanguine composition (Fig. 1 – 3) [8, 9].

Conclusions

1. The psychophysical state of man includes a number of individual characteristics that are decisive and can be specified by mental and physical characteristics.

Unconditional circumstances are the function of arousal and the subsequent transient process, the results of which have objective consequences, because they are due to the action of physical laws and do not depend on subjective desires.

2. Understanding the analogy between the state of processes in wildlife storage and technology is necessary to take into account in everyday activities and, especially, in emergencies and hostilities.

3. Active mental activity should be carried out during the responsible, anxious moments, the time of expectation, etc.: analysis of the situation, search for the best options for completing the task, poems, songs (religions usually recommend prayers). This will eliminate the possibility of losing control of the

environment, eliminate the formation of panic, fear and negative mental phenomena.

In any case, it is essential not to remain in a state of unconsciousness and apprehension, as the induced function will in this case lead to stupor and the impossibility of responding gracefully to the threat and taking a positive decision. The time of the transition process depends on the psychotype of the person and can be shortened by special training, experience and a conscious attitude towards autotraining.

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Received (Надійшла) 27.01.2022

Accepted for publication (Прийнята до друку) 06.04.2022

Технічні аспекти моделювання психофізичного стану військовослужбовця в екстремальних ситуаціях та бойовій обстановці

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Анотація. Предметом вивчення в статті є психофізичний стан людини в екстремальній обстановці. **Метою дослідження** є надання рекомендацій щодо поведінки людей в умовах миттєвої дії функції збудження та наступного перехідного процесу. **Завдання дослідження:** розглянути психічний та фізичний стани людини, з точки зору основних положень теорії перехідних процесів в електричних колах та визначити аналогію між станом процесів у накопичувачах у живій природі і техніці та зробити висновки про можливість їх конкретизації за психічними та фізичними особливостями; застосувати теоретичні положення теорія перехідних процесів з двома накопичувачами енергії для моделювання психофізичних складових стану людини в екстремальних ситуаціях та бойовій обстановці; на основі досліджень зв'язку психотипу людини з мірою інерційності для поведінки у перехідному процесі та оцінкою можливого часу до його завершення надати рекомендації щодо поведінки людини, зокрема військовослужбовців, у екстремальних ситуаціях та бойовій обстановці. Методологічною основою дослідження стали загальнонаукові та спеціальні методи наукового пізнання. **Отримані наступні результати:** Проведена аналогія електромагнітного та психофізичного стану людини з виділенням двосдиних процесів дозволяє застосувати теоретичні положення опису одного виду (електромагнітного) для обґрунтування поведінки інших психофізичних складових. Реалізація результатів даного дослідження дозволяє для широкого загалу з різною теоретичною підготовкою з'ясувати правила поведінки у важких життєвих ситуаціях. **Висновки.** Психофізичний стан людини включає низку індивідуальних особливостей, які є визначальними і можуть бути конкретизовані психічними та фізичними особливостями. Безумовними обставинами виступають функція збудження та наступний перехідний процес, результати дії яких мають об'єктивні наслідки, бо зумовлені дією фізичних законів і не залежать від суб'єктивних бажань. Розуміння аналогії між станом процесів у накопичувачах у живій природі і техніці необхідно для врахування у повсякденній діяльності і, особливо, в умовах надзвичайних ситуацій та бойових дій. У відповідальній, тривожній моменти, під час очікування, тощо, повинна здійснюватися активна розумова діяльність: аналіз ситуації, пошук найкращих варіантів виконання завдання, вірші, пісні (релігій традиційно рекомендують молитви). Це виключить можливість втрати контролю над оточенням, виключить утворення панічного стану, страху та негативні психічні явища. Жодним чином необхідно не залишатись у нерухомому очікуванні та оціпенінні, адже функція збудження призведе, у цьому випадку, до ступору і неможливості миттєво реагувати на небезпеку та прийняття вірного рішення. Час перехідного процесу залежить від психотипу людини та може бути скорочений за рахунок спеціального тренування, набуття досвіду та свідомим ставленням до аутотренінгу.

Ключові слова: психофізичний стан людини, перехідні процеси в електричних колах, психотип людини, екстремальні ситуації, бойова обстановка.