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STRATEGY OF MATHEMATICAL MODELING OF CONFLICTS BASED ON GAME THEORY

Annotation

The article presents strategic methods of mathematical modeling of conflicts that are frequently repeated in modern society. Although game theory was initially used in economic and mathematical sciences, as a result of recent research, it has been proven that it can be successfully used in social sciences as well. It is known that the problem of preventing and avoiding any conflict is becoming one of the most relevant topics every year. However, while social science shows us that conflicts can only be observed, using mathematical methods we can manage and predict conflicts. The scientific article also contains information about the researchers who worked in the mentioned topic. There are also scientific examples of how conflict can be represented and studied in game theory.

It is known that the application of game theory in conjunction with the diffusion equation quickly brings us closer to the truth. It is known that the application of the theory of games together with the diffusion equation quickly approaches the truth. In the modern era, we can see that conflicts have developed in an evolutionary way. We can also make sure that the tools of social research that were used to monitor conflicts in the 20th century will not work well in the new millennium. It seems that the first priority for the science of conflictology is to increase the practical fund as much as possible. For the development of the domestic science of conflictology, a large base fund of works and research by European and world scientists is needed. When there is a need to form competent conflict experts, we understand the need for specialists who can use the methods of natural sciences such as game theory, mathematical modeling, and diffusion equations in social sciences. After all, without the aforementioned mathematical methods for predicting and modeling future conflicts, it is undoubtedly difficult to achieve that goal.

Keywords: game theory, game theory strategy, mathematical modeling, conflicts, political and social equivalents, information resources, diffusion equation.

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ОЙЫН ТЕОРИЯСЫНА НЕГІЗДЕЛГЕН ҚАҚТЫҒЫСТАРДЫ МАТЕМАТИКАЛЫҚ МОДЕЛЬДЕУ СТРАТЕГИЯСЫ

Аңдатпа

Мақалада заманауи қоғамда жиі қайталанатын қақтығыстарды математикалық модельдеудің стратегиялық әдістері ұсынылған. Ойын теориясы бастапқыда экономикалық және математикалық ғылымдарда пайдаланып жүргенімен, соңғы зерттеулердің нәтижесінде оны әлеуметтік ғылымдарда да сәтті пайдалануға болатындығы дәлелденді. Кез-келген қақтығыстың алдын алып оны болдырмау мәселесі жыл өткен сайын ең өзекті тақырыптардың біріне айналып келе жатқандығы мәлім. Алайда

әлеуметтік ғылым бізге қақтығыстарды тек бақылауға болатындығын көрсетсе, математикалық әдістерді пайдалану барысында біз қақтығыстарды басқаруға және болжауға мүмкіндік ала аламыз. Ғылыми мақалада сонымен қатар аталмыш тақырып аясында еңбектенген зерттеушілер туралы мағлұматтар келтірілген. Ойындар теориясына қандай жолмен қақтығысты енгізіп, оны қалайша зерттеу керектігі туралы мысалдар да жазылған.

Ойындар теориясының диффузиялық теңдеумен қатар қолданылуы ақиқатқа тез жақындататыны мәлім. Жаңа заманда қақтығыстардың эволюциялық жолмен дамығандығын байқаймыз. XX ғасырда қақтығыстарды бақылауға арналған әлеуметтік зерттеу құралдарының жаңа мыңжылдықта жақсы жұмыс жасамайтындығына да көз жеткізсек болады. Конфликтология ғылымы үшін қазір ең бірінші кезекте тәжірибелік қорды мүмкіндігінше молайту мәселесі тұрған секілді. Отандық конфликтология ғылымының дамуы үшін де Еуропалық зерттеушілердің еңбектері мен зерттеу жұмыстарының үлкен базалық қоры қажет. Сауатты конфликтологтарды қалыптастыру қажеттілігі туындаған сәтте ойындар теориясы, математикалық модельдеу, диффузиялық теңдеу секілді жаратылыстану саласының әдістерін әлеуметтік ғылымдарда жетік пайдалана алатын мамандардың керектігін түсінеміз. Неге десеңіз келешек конфликтілерді болжау әрі модельдеу үшін жоғарыда айтылған математикалық әдістерсіз ол мақсаттың орындалуының өзі қиын екені сөзсіз.

Түйін сөздер: ойын теориясы, ойын теориясының стратегиясы, математикалық модельдеу, қақтығыстар, саяси және әлеуметтік эквиваленттер, ақпараттық ресурстар, диффузиялық теңдеу.

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СТРАТЕГИЯ МАТЕМАТИЧЕСКОГО МОДЕЛИРОВАНИЯ КОНФЛИКТОВ НА ОСНОВЕ ТЕОРИИ ИГР

Аннотация

В статье представлены стратегические методы математического моделирования конфликтов, часто повторяющихся в современном обществе. Хотя теория игр изначально использовалась в экономических и математических науках, в результате недавних исследований было доказано, что ее можно успешно использовать и в социальных науках. Известно, что проблема наблюдения и предотвращения любых конфликтов с каждым годом становится одной из самых актуальных тем. Однако, хотя социальные науки показывают нам, что конфликты можно только наблюдать, используя математические методы, мы можем управлять конфликтами и предсказывать их. В научной статье также содержится информация об исследователях, работавших по указанной тематике. Есть также научные примеры того, как конфликт можно представить и изучить в теории игр.

Известно, что применение теории игр совместно с уравнением диффузии быстро приближает к истине. В современную эпоху мы видим, что конфликты развивались эволюционным путем. Мы также можем быть уверены, что инструменты социальных исследований, которые использовались для мониторинга конфликтов в 20-м веке, не будут хорошо работать в новом тысячелетии. Представляется, что первоочередной задачей науки конфликтологии является максимальное увеличение практического фонда. Для развития отечественной науки конфликтологии необходим большой базовый фонд трудов и исследований европейских и мировых ученых. Когда возникает необходимость в формировании компетентных экспертов по конфликтам, мы понимаем необходимость в

специалистах, которые могут использовать методы естественных наук, такие как теория игр, математическое моделирование и уравнения диффузии в социальных науках. Ведь без вышеупомянутых математических методов прогнозирования и моделирования будущих конфликтов достичь этой цели, несомненно, сложно.

Ключевые слова: теория игр, стратегия теории игр, математическое моделирование, конфликты, политические и социальные эквиваленты, информационные ресурсы, диффузное уравнение.

MAIN PART

Often, situations arise when choosing a single action from a multitude of options, involving multiple opponents. These situations are known as conflicts in conflict science. There are times when you have to choose only one of many possible situations. In such cases, the number of opponents involved in the conflict may also be large. Such situations are called conflicts in the science of conflictology. In most cases, the opposing party's goals are ignored. Due to this, the conflict escalates and rises to a new level. Researchers explain that this is due to the lack of close attention to the opposing side. For such conflicts, there is a system that helps each party to the conflict to perform specific optimal actions. They can choose a type of activity that works for them [1, 73-75 c.].

Game theory is the most adequate method of solving political problems among other mathematical methods of research. The popular mathematician John von Neumann had the same opinion. Mathematical game models have quite far-reaching directions that go beyond conflict situations in the socio-economic sphere, and which apply the interaction between people and nature, politics and the military sphere. [1, 92-93 c.].

INTRODUCTION

The outstanding mathematician John von Neumann was more than confident that modern political science should in turn be guided by the principles of mathematical research. It is true that game theory is the most suitable and optimal among the existing mathematical methods for the study of political conflicts. Game theory, which is used more in economics than in mathematics, is a large institutionalized research theory that can encompass the common interactions between humans and the environment, politics, and the military. In the first place, it can cover not only conflicts, but also a wide economic one.

Scientific novelty of the article. We've noticed that new types of conflicts have emerged in contemporary society. While social sciences have attempted to assess conflicts using their own methods and common approaches, it's been observed that not all results accurately reflect reality. Therefore, since the 20th century, a number of researchers have used game theory to study strategically important projects.

Over time, the high results of game theory in American research institutes aroused scientific interest among researchers, and game theory began to be used in social sciences. In the dynamic movement of conflicts, we notice that the excitation (escalation) equivalents change due to the easy transition of the initial goal to the next new goal. That is, a conflict in any range of motion can impose tasks that must be performed at a certain level. It is known that classical methods of monitoring and predicting them do not lead to an objective solution. And, in the process of mathematical modeling of conflicts through game theory, it is possible to reach the truth faster. There is no doubt that the academic value of game theory is also high.

LITERATURE REVIEW

It is true that a number of research works have been written for the practical analysis of such a complex interdisciplinary field. Research works of foreign scientists have made a significant contribution to the development of modern conflict science. In the 20th century, the joint works of John von Neumann and Oscar Morgenstern were first released, in which the humanitarian

bases and applications of the practical part of this theory were mathematically investigated.The name of the book was "Game Theory and Economic Behavior" [1, 97-c.].

Later, this great mathematical theory began to be recognized in social sciences as well. Forbes Jr. Nash laid a new foundation for game theory and was the first to propose a project for its application in the social sciences. John Nash and S. Reinhard and H. Economists like John proved that game theory can be used not only in economics, but also in political science. J. Gerda invented an open form of game theory. He proposed the description and classification of political games during political conflicts, and wrote the types of methods that could be developed in the future.

Subsequently, game theory for predicting conflicts began to be studied by such scientists as: K. Sonin, B. Mirkin, A. Vasin, M. Raskin, N. Parker, N. Taleb, G. Owen, M. Templeton, J. Harsanyi, etc. K. Boulding was the first to talk about the need to introduce mathematical modeling to predict conflicts. N. Parker in his research proved that game theory gives more objective answers if it is applied in the field of political modeling [1, 110-c.].

METHODOLOGY

Research methods: analysis, game theory, theory of large games, index indicators, synthesis, scientific topology, creation of logical-algebraic systems, diffusion equations, comparison, k-research, etc.

This scientific article deals with the area of complex dynamic change of game theory. This article discusses the probabilities of predicting political conflicts in addition to predicting complex economic issues through game theory, including rational methods for mathematical modeling of the outcome. The author was given the following objectives:

- To carry out an in-depth analysis of the theory that serves as the primary element of tactical observations in economics.
- Demonstrate practical models used in game theory, management, and other directly related fields.
- Analyze the practical achievements of mathematical modeling in various fields.
- To investigate strictly defined structures and tools used in conflict modeling.

Research level. It is true that game theory was originally a branch of applied mathematics. Later, it became a separate interdisciplinary field with fully developed empirical research methods. Therefore, game theory is widely used in other fields of science. Within the framework of game theory, there are many scientists who have written their works for social sciences [2].

Among them: A. N. Kolmogorov, J. Nash, R. D. Fisher, N. Parker, N. Taleb, K. Boulding, A. Cournot, J. Bertrand, E. Lasker, E. Zermelo, E. Borel. and so on. Although the theory of games appeared in the XIX century, it began to take shape as a theory capable of making full-fledged scientific predictions only in the XX century.

In 1929, a game model (linear city model) based on the game theory of market competition proposed by G. Otelling was published. And in 1957, E. Downs model of political competition brought new success to science. At the same time, new information about the physical space of the market competition model has entered the science. In these studies, it is said that the large-scale increase in voter preferences also leads to new disturbances in the political space.

Over the past decade, numerous scientific studies have been published in the field of domestic conflictology, specifically focusing on this topic [2].

RESULTS

At the beginning of the article, we said that mathematical methods and methodologies were initially used only in mathematics. The field of mathematical modeling, which brought a new revolution to the science of mathematics, also gave a new impetus to the social sciences. This field, which requires mathematical calculations, was later filled with new theories such as game theory. The prospects of game theory, which are based on social sciences, are currently only 20% developed, which is a low value.

Political processes that can be modeled within the framework of game theory can be divided into a certain number of moments:

1. Basic operational research (game theory, which is used as a research tool for conflict content, is considered a major part of it).

2. Auxiliary Operations Research (IO). This type of research is a special mathematical tool designed to support decision-making activities of social groups in various areas.

Operations research also refers to any means of providing decision makers with the necessary quantitative information obtained using the scientific method. The trend towards operations research has emerged at the intersection of mathematics and various socio-economic sciences. [3, 334-335 p.].

The era of Frederick Lanchester is famous for the fact that in this era the first impressive implementation of mathematical modeling for the settlement of multidimensional military-strategic problems was noted. His exposition of «Lanchester's Law of Squares» became one of his leading contributions, published in 1916.This principle highlights the relationship between numerical superiority and combat effectiveness, demonstrating that the relative strength of a force increases with the square of its numbers when two sides engage simultaneously. Lanchester’s work emphasized the importance of numerical advantage and its impact on the outcome of battles.

Over time, this theory evolved to incorporate advancements in both social and physical weaponry. The primary objective, according to Lanchester, was to maximize the efficiency of one’s forces by concentrating them while simultaneously fragmenting the enemy’s. This approach often yielded favorable results in combat. In the Battle of Trafalgar, you can see that Lanchester's quadratic law was used. The principle of concentration of forces became the basis for the successful achievement of victory. This fact has been noted in history. Lanchester concepts have been added to a number of collections from Lanchester's time, which have received widespread appreciation in their time and to this day.

The military and tactical development of operational plans has become characterized by the use of game theory, which is also defined as mathematical models for decision-making in conflict situations. The works of scientists Zermelo and Burrell at the beginning of the 20th century define the beginning of game theory. Nevertheless, John von Neumann's particularly visionary contribution influenced the future of modern game theory. Von Neumann not only formulated but also rigorously proved its foundational principles, introducing new axioms that became central to the theory’s core framework. In military strategy, this work has become a landmark event, leading to the improvement and comprehensive use of game theory, as well as in various fields. [4, 298-c.].

Conflict incidents in games have gained massive prospects for productive resolution due to the rapid improvement and popularization of computers. But most of the essential questions remain open, despite the tangible theoretical breakthrough. Of paramount importance is the analysis and implementation in such industries as:

- Analysis of the practical implementation of these settlement proposals.
- Creation of solutions for defining games.
- Proof of theorems, indicating the presence of solutions.
- Development of practical methods for finding solutions.

Both in virtual and real situations, there is a place to apply the developed mathematical model, analytical solutions and transformations. The game is based on a developed mathematical model of a conflict involving two or more parties, each of which wants to achieve a different kind of goal. Alliances or coalitions are created when participants with common conceptual interests come together to counteract opposition strikes.

By directing attention to the opposing participants in the game, the game model is a method of optimizing situations. Take, for example, two criminals with different goals, whom the participants may represent during the investigation. In such situations, the need to make strategic

decisions requires each player to develop a unique plan of action tailored to the conflict [5, 67-68 c.].

The triumph of a strategy is directly related to the order in which it is implemented. The result of the player's fruitful actions is victory. Measuring the results of various tournaments is a difficult task, since game theory considers only those games in which there is numerical evidence of victory. Clearly, the game's outcome and, consequently, victory, are quantifiable.

In game theory, it is good to emphasize three important things:

1. Pre-grouping of actions that the players may do recently;
2. Learning the goals and tasks of the parties participating in the game;
3. To increase the stock of information related to all parties.

Game theory is known to make good predictions about the scope and future steps of conflicts. It is known that in the process of mathematical modeling of all statistical information obtained from game theory, we can achieve analytical truth.

Games of a uniform standard

Such games can be classified as statistical games. A dynamically developing game of this kind is often used to predict political conflicts. This type of game in normal form can describe the game itself as an object in process.

G: = <I, X, u(.)> = <I, $\{X_i\}_{i\epsilon I}$, $\{u_i(.)\}_{i\epsilon I}$ > it's here I: = {1, …., m} the number of participants in the conflict.

X: = $(X_i)I \epsilon I$: = $\Pi_i X_i = (X_1 x X_2 x ..... x X_m)$ set (profile) of admissible $\{X_i\}_{i\epsilon I}$ sets of participant strategies [6, 46-47 c.].

Any social group involved in political conflict is completely governed by the aforementioned game theory. But it should not be forgotten that the dynamic field of political conflict depends on how this process (conflict) is realized. It is true that if the dynamic waves develop at a rapid pace during the conflict, the social temperature will also change. The faster the social conflict develops, the faster the social temperature rises [6, 63-c.].

It is true that game theory is very important for conflictology. It is known that European scientists have been using game theory in the new millennium to solve the most complex and urgent problems of the human race. It is also known that a set of unresolved issues always creates favorable conditions for the emergence of new conflicts. M. Thatcher wrote in her diary that there are certain reasons behind the conflict that occurs within each country. That is, it is unlikely that there will be a conflict without a reason. Conflicts that arise without a reason are often not viable. Such conflicts can be resolved easily and quickly.

When the level of tension is reached, the conflict "a" may refuse to fulfill its original requirements and lead to the goal "b" and become chaotic. That is, several new conflicts may be added to it within the framework of "a" conflict, which has come out of its original framework. This is called the conflict paradox.

Game theory is not only a tool for conflict observation, but game theory is useful for conducting complex scientific research on where conflicts originate and how they might develop in the future. Game theory, a powerful mathematical tool, aids in predicting various conflicts, including social, political, inter-party, religious, inter-ethnic, international, military, market, information, and more.

Varies depending on the strategies employed by each player. In a specific case, the outcome entirely rests on the participant's actions. This situation is not considered a game, and defeat is viewed as a negative outcome. Therefore, in the future, only winnings will be considered [7, 472-473 p.].

It is determined that the opinion that the political breakthroughs of some of the participants correspond to the costs of other participants (a game of zero), sometimes does not correspond to a systematic approach to the concept of sustainable development of the international community. This balance has repeatedly been a factor in the deterioration of the political situation. Therefore,

a variety of methods must be used to apply the basic principles of game theory. Game theory remains the most effective tool for conflict analysis. [7, 481 p.].

According to the view, the genesis of conflict situations at military events is a consequence of certain problems. These tasks include various factors such as rules, conditions, participants, strategies, actions, and possible outcomes. These elements can be mathematically modeled as "if-then" scenes. The goal is to turn real-world goals into the official format of the game. The process includes formulating a solution, choosing the optimal model, performing calculations, and analyzing the results.

Game theory and conflict modeling

In game theory, based on practical experience, it's crucial to focus on the opposing players. Negotiating without a coalition or specific agreements that can't be part of it is possible. In the absence of an important alliance, only two players participate in the game, and their wins and losses are proportional. This game is commonly known as a "two-player zero-sum game," where the gain of one player is exactly balanced by the loss of the other. For example, if Player 1's victory is worth V, then Player 2's corresponding defeat is -V, meaning the total outcome adds up to V + (-V) = 0. Player 1 chooses from a set of possible strategies (such as two or three alternatives) without knowing what strategy Player 2 will adopt. Similarly, Player 2 remains unaware of Player 1's choices and must make a decision based on their own assumptions. When no player can count on a guaranteed positive result, the focus shifts to minimizing losses through careful strategic planning.

For clarity, let's analyze virtual games. The formation of dynamic processes is facilitated by the implementation of tactics identical to those used in real military operations. Various kinds of situations will form during the fighting:

1. The opponents are pressing in from the west [8, pp. 195-196].
2. The solution has three vectors (1,2,3).
3. Capture the group with the assigned combat mission: go against the enemy,
participate in open battles and defeat them.
4. The crew has three directions of movement. The path allows you to determine where two groups will pass close to each other. [9, 388 p.].

Based on this, the collision sites are located at different heights, their total number is nine. The lowest height above the enemy is the most favorable for the capture group to engage in open combat. This tactic gives a sense of determination and security in the mountains [9, p. 402-403]. The estimated outcomes are shown in the table. However, the rational vector of a group cannot be defined as an immutable basis. If we select the location of the battle as the victorious one, we take into account the height of the terrain obtained from the other side. Success will be negligible, as an increase in altitude is not strategically favorable for them. The final table of winnings looks like this:

$$\left(\begin{array}{cccccc} & -5,\ 0 & -1{,}5 & -3{,}0 & & \\ \hline -0{,}5 & -1{,}0 & 0{,}0 & -2{,}0 & -1{,}0 & -1{,}8 \end{array}\right)$$

To determine the optimal strategy for the film crew, we'll employ a method that involves identifying the most inconvenient solution option for each scenario. The outcome of this process depends on the actions of the opponent, after which we select the maximum value from the irradiated set of potential winnings. This approach ensures that we obtain the guaranteed best possible outcome. Additionally, we'll consider the worst actions of the opponent and determine victory based on the principle of "the best of the worst." For this, we will analyze all the rows of the matrix corresponding to different directions of the crew. When making a decision,we give priority to the first trend(A), the lowest winner -5.0. The second (non)direction is determined by the minimum value of the second row, -1.0. Finally, the third direction(seed)is determined based on the minimum value of -2.0 in the third row of the matrix.

The maximum gain found is -1.0, so the second route from the battlefield was chosen, which didn't exceed 1.0 kilometers. This predetermined height determines the discount for the second line. It's not surprising that when opponents choose different directions, they adjust the path.

However, the estimated height of the region is still 0.5 and 0 kilometers. Therefore, the second direction (B) is optimal to minimize the costs for the filmmakers. The new coefficient, called the price of the game in the group, is set to -1.0 [9, 418-419 p.].

There are two subjects involved in this game: a person, whom we will designate as player M, and nature, represented by player N. The basic principles of classical game theory concerning these participants are as follows:

1. Player N, being the second participant in the game, is neither an opponent nor an ally of player M. He accepts the states of player M indefinitely, with no specific goal and no interest in the outcome of the game.

2. Player M's decisions do not directly affect Player N's position or actions. [10]

Using the diffusion equation, it is possible to model this conflict mathematically, without the need to use information technologies based on game theory. Calculating future conflicts according to the principles of the game, we can check the correctness of the answer by comparing it with the spread index [11, 144-145 c.].

The function $f(x_i, x_j)$ characterizes the connection between individuals, which is modeled here using the classical Gaussian distribution

$f\left(x_i, x_j\right) = \frac{1}{u\sqrt{\pi}} e^{\frac{-(x_i - x_j)^2}{u^2}}$,

$u = k_c^i k_s^i + k_c^j k_s^j$, is quite widely used in various sociological studies.

k_s^i – coefficient of scientific and technological progress and development of the i-th individual/group of individuals.

k_c^i – coefficient of social activity of the i-th

individual/group individual.

$\bar{\delta}$ – is the inverse Kronecker delta [12, 165-166 p.].

Using Game Theory with the Diffusion Equation

Game theories can be used in scientific research in parallel with the diffusion equation. This helps to model the starting position of any conflict. The diffusion equation can show the dynamics of an event. But if we expand its capabilities using game theory, we will get a ready-made analytical methodology for predicting conflicts. After completing the variational series in the theory of patterns based on complete statistical information, a diffusion study is needed. In the course of research, we can give examples of some types of diffusion equations:

$$\{\frac{\partial h(x_1;t)}{\partial t} = D\left[h\left(x_1,\ t\right) - h\left(x_1,\ 0\right)\right] + \alpha k_c^2 k_5^1 e^{\frac{\psi^2+1}{\psi}} (x_1 + x_2)^2,\ \frac{\partial h\left(x_2;t\right)}{\partial t} = D\left[h\left(x_2,\ t\right) - h\left(x_2,\ 0\right)\right] +$$

When: $\Psi = k_c^1 + k_5^1 + k_c^2 + k_5^2$, $\alpha = \frac{1}{\Psi\sqrt{\pi}} \bar{\delta}_{k_c^1 + k_5^1,\ k_c^2 + k_5^2}$.

To obtain approximate analytical solutions of a system of equations, a series expansion with an accuracy of to the quantity of the first order of smallness for: $\Delta x = x_i - x_{0i}$, $\Delta t = t - 0$ difference [13, 481-482 p.].

$$h\ (x_i, t) - h\ (x_{0i}, t) \approx \frac{\partial h}{\partial x_1} \left|(Here\ the\ following\ meaning)\quad t = 0\ \Delta x + \left(\frac{\partial h}{\partial t}\right) x_i = x_{0i}\ (4)\ \right|\ \Delta t \qquad x_{0i} = 0$$

$$h\ (x_1, t) = D\int_0^t x_1(u)du + D\frac{(t)^2}{2} + \alpha k_c^j k_s^i \int_0^t e^{\frac{\psi^2+1}{\psi}(x_i(u) + x_j(u))^2} du,\ j = 3 - i.$$

After differentiation with respect to time, the following forms of the differential equation are obtained based on game theory:

$$\{\frac{d^2x_1}{dt^2} = k_c^1 k_s^1 D + \frac{2\alpha(\psi^2+1)k_c^1 k_s^1 k_c^1 k_s^2}{\psi^2}(x_1 - x_2)e^{\frac{\psi^2+1}{\psi}(x_1-x_2)^2} + \sqrt{2D}\frac{d\xi_1(t)}{dt},\ \frac{d^2x_2}{dt^2} = k_c^1 k_s^1 D + \frac{2\alpha(\psi^2+1)k_c^2 k$$

Using game theory, fully differentiable mathematical coefficients can be modeled without the help of information technology as mentioned above. That is, in the process of modeling conflicts within the state, we get closer to the truth. We have noticed that the correct solution can always be reached easily and quickly by means of mathematical methods.

DISCUSSION

Now let's look at the actions of a particular enemy. In the context of a conflict situation, to identify the most optimal strategy for behavior, various modeling approaches can be considered [14, 112-113 p.]. These strategies may involve complex or challenging scenarios, such as difficult alpine terrain. We begin by applying the inverse algorithm. This method involves identifying the highest values in each column, and then selecting the minimum of these values. This minimum value helps to determine the success of the capturing group and effectively prevents the opponent from achieving any new outcomes. For example, the columns with the maximum values are -0.5, -1.0, and 0.0, and the minimum of these is -1.0. As a result, the opponent's highest value of 1.0 in the second strategy serves to block the defeat of the capturing group, maintaining at least a 1.0 km height in the conflict. The cost of the game for the opponent is -1.0, meaning both rivals incur the same losses. Mathematical modeling is a useful tool for formulating strategies, and its application is clear. However, when selecting a saddle point, positional aspects must also be considered. By observing the terrain from a strategic vantage point, we can pinpoint the intersection of the roads (B) and (2), where the saddle point is located [15, 134-135 p.].

Matrix games, when applied to a specific strategy and dimensions, can be automated using the MS Excel spreadsheet software. As the field of Conflict Studies has developed, we can see that recently traditional social views have begun to be taken into account. In connection with this problem, we have come to the time of using new methods and techniques. In predicting many military and civil conflicts, we can achieve a well-known predictive result through Game Theory. Although game theory is now included in domestic textbooks, the limited amount of research being conducted presents challenges in addressing these questions.

But in the course of explaining game theory, we noticed that sometimes the parties involved in conflicts quarrel because they do not recognize each other positionally. It is true that the ability to predict becomes more difficult due to the distribution of emotions that are not in the plan, moving freely on the field of falling into a rational position. Sometimes such cases occur even among states of the international level. As an example, we can cite the German invasion through Belgium of strategically important points on French soil according to the Schlieffen Plan, so that it would take a rational position during the first World War. I believe that we are convinced that the competition of the human race to occupy a strategically important place can influence the emergence of conflicts [16, 441 p.].

In the new world, the evolution of conflict Genesis takes place at a new pace, sometimes out of control and control. And the social methods and techniques used in the last century do not give us the best results in solving this problem. It is true that there is a need to use new methods for this purpose. Game theory can give a new impetus to the formation and development of the genesis of conflicts.

As outlined in earlier sections of this article, game theory, when combined with other mathematical techniques, has the potential to offer meaningful solutions to modern conflicts. This area remains underexplored and calls for further investigation.

CONCLUSION

In the application of game theory in scientific research, we see how far the social sciences have progressed. We can see that the nature and content of the conflicts in the new millennium

are completely different from the conflicts of the 20th century. In the era of massive globalization, the difficulty of implementing conflict prevention measures has become clear.

As the market competition is developing day by day, tools that constantly monitor conflicts as possible are becoming obsolete. Also, the question arises as to how long the optimal ways and mechanisms for solving external and internal political problems in the life of the state can prevent mass disturbances of a chaotic nature. It is clear that such a question worries any country.

For a country like the Republic of Kazakhstan, which gained its independence recently, it is better to learn European experience. It is clear that the development of domestic conflict science reduces the probability of conflicts that may occur within the state. Therefore, in the future, there is a need to form the political elite from young people with political knowledge.

In order to become a complete conflict researcher, it is necessary to master mathematical methods in addition to social research methods and tools. As I wrote in the article, it is clear that the methods of predicting conflicts of the last century will not give fundamentally positive results in the new century. Therefore, the development of game theory in the social sciences can contribute to the achievement of better outcomes. Game theory has yet to fully realize its potential in this field.

By combining game theory with other mathematical methods, we can gain a closer understanding of social reality. Before attempting to model all possible conflicts mathematically, it is crucial to consider the evolutionary development of these conflicts. Subsequently, we can evaluate potential solutions using game theory.

Finally, possible solutions of the obtained variational series can be easily differentiated with the help of diffusion equations. Such a mathematical algorithm is called combinatorial calculation.

Currently, domestic conflictology needs foreign experience and qualified researchers. Using the game theory, it is possible to predict mass riots, such as the "Blood January incident" that caused panic in the country, and the "Oilmen's strike in Zhanaozen", which led to conflicts between the big authorities and the local population. Mathematical methods are more objective than social interviews aimed at predicting conflicts. In addition, it should be noted that the process of processing a social survey takes a very long time.

The use of Game Theory in the social sciences leads to the opening of New Horizons. It is obvious that mathematical methods play a huge role in social science. In the future, we will be able to easily simulate conflicts in general or in particular using other theoretical new methods. Summing up my thoughts, I would like to conclude my article with the fact that mathematical modeling through game theory is the most objective research tool that can directly describe and evaluate civil and military conflicts, allowing you to understand the nature of conflicts taking place in modern society.

REFERENCES:

1. Ласло М. Вычислительная геометрия и компьютерная графика. М.: издательство «Феникс», 2021. 422 с.

2. Левин В. Л. Логико-алгебраический подход к моделированию конфликтов//Системы управления, связи и безопасности. 2015. №4. С. 69-87. URL: http: //sccs.intelgr.com/archive/2015-04/03-Levin.pdf (Дата обращения: 17.10.2024).

3. Wakayama T. Comparison of voluntary contribution and Pareto-efficient mechanisms with voluntary participation. Journal of game theory. 2023. 52rd volume, second issue 517-553 p. https://link.springer.com/article/10.1007/s00182-022-00828-x. (Date of access: 11.10.2024).

4. Мазалов В. В. Переговоры. Математическая теория. М.: издательство «Когнито-центр», 2012. 304 с.

5. Шведовский В. А., Социолого – математические модели в исследовании социальных процессов. М.: диссертация на соискание ученой степени доктора социологических наук, 2010. 150 с.

6. Айзекс Р. Дифференциальные игры. М.: издательство «Мир», 1967. 480 с.

7. Joseph K. The political significance of social media activity and social networks. Political communication. 2018. 35:3, 470-493 p.

8. Покорная О. Ю. О выборе оптимальных стратегий в планировании боевых операций. Воронеж: издательство ВАИУ, 2009. 194-198 с.

9. Malte B. Pure Nash equilibrium strategy for collective choice bargaining models. Journal of game theory. 2023. 53rd volume, second issue 373-421 p. https://doi.org/10.2307/2586381. (Date of access:12.10.2024)

10.Покорная О. Ю. Интеграл Стильтьеса в теории игр //Молодой ученый. 2012. №3 (38). 26-28 с.

11.Шагин В. Л. Теория игр. М.: «издательство Юрайт», 2015. 223 с.

12.Болотский А. В. Математическое программитрование и теория игр. М.: издательство «Лань», 2022. 272 с.

13.Kavamura K. Efficient equilibria in voting games with common interests. Journal of game theory. 2023. 53rd volume, second issue. 475-492 p. https://doi.org/10.2307/2586381. (Date of access: 12.10.2024)

14.Мазалов В. В. Сетевые игры. М.: издательство «Лань», 2022. 320 с.

15.Горстко А. Б. Познакомьтесь с математическим моделированием. М.: издательство «Знание», 1991. 162 с.

16.Beal S. Priority value for cooperative games with a priority structure. Journal of game theory. 2022. 53rd volume, second issue. 431-450 p. https://ideas.repec.org/p/crb/wpaper/2020-02.html. (Date of access: 13.10.2024)

REFERENCES:

1. Laslo M. Vychislitelnaya geometriya i kompyuternaya grafika. M.: izdatelstvo «Feniks», 2021. 422 s.

2. Levin V. L. Logiko-algebraicheskij podhod k modelirovaniyu konfliktov//Sistemy upravleniya, svyazi i bezopasnosti. 2015. №4. S. 69-87. URL: http: //sccs.intelgr.com/archive/2015-04/03-Levin.pdf (Data obrasheniya: 17.10.2024).

3. Wakayama T. Comparison of voluntary contribution and Pareto-efficient mechanisms with voluntary participation. Journal of game theory. 2023. 52rd volume, second issue 517-553 p. https://link.springer.com/article/10.1007/s00182-022-00828-x. (Date of access: 11.10.2024).

4. Mazalov V. V. Peregovory. Matematicheskaya teoriya. M.: izdatelstvo «Kognito-centr», 2012. 304 s.

5. Shvedovskij V. A., Sociologo – matematicheskie modeli v issledovanii socialnyh processov. M.: dissertaciya na soiskanie uchenoj stepeni doktora sociologicheskih nauk, 2010. 150 s.

6. Ajzeks R. Differencialnye igry. M.: izdatelstvo «Mir», 1967. 480 s.

7. Joseph K. The political significance of social media activity and social networks. Political communication. 2018. 35:3, 470-493 p.

8. Pokornaya O. Yu. O vybore optimalnyh strategij v planirovanii boevyh operacij. Voronezh: izdatelstvo VAIU, 2009. 194-198 s.

9. Malte B. Pure Nash equilibrium strategy for collective choice bargaining models. Journal of game theory. 2023. 53rd volume, second issue 373-421 p. https://doi.org/10.2307/2586381. (Date of access:12.10.2024)

10. Pokornaya O. Yu. Integral Stiltesa v teorii igr //Molodoj uchenyj. 2012. №3 (38). 26-28 s.

11.Shagin V. L. Teoriya igr. M.: «izdatelstvo Yurajt», 2015. 223 s.

12. Bolotskij A. V. Matematicheskoe programmitrovanie i teoriya igr. M.: izdatelstvo «Lan», 2022. 272 s.

13. Kavamura K. Efficient equilibria in voting games with common interests. Journal of game theory. 2023. 53rd volume, second issue. 475-492 p. https://doi.org/10.2307/2586381. (Date of access: 12.10.2024)

14. Mazalov V. V. Setevye igry. M.: izdatelstvo «Lan», 2022. 320 s.

15. Gorstko A. B. Poznakomtes s matematicheskim modelirovaniem. M.: izdatelstvo «Znanie», 1991. 162 s.

16. Beal S. Priority value for cooperative games with a priority structure. Journal of game theory. 2022. 53rd volume, second issue. 431-450 p. https://ideas.repec.org/p/crb/wpaper/2020-02.html. (Date of access: 13.10.2024)