AMERICAN Journal of Public Diplomacy and International Studies
Volume 01, Issue 09, 2023 ISSN (E): 2993-2157

SOURCE AND START IN DECREASAL EQUATIONS ' CORRECT BY IDENTIFYING THE INNER FUNCTION PROBLEMS

Latipova Shahnoza Salim daughter
Asia International University
General technician Department of Sciences teacher
slatipova543@gmail.com

Abstract: this article Caputo in the sense of fraction in order private derivative differential equation for mixed issue we learn This in the article right issue solve and In Caputo's sense show that the solution of the partial differential equation of fractional order exists and is unique , and it is intended to obtain results related to the correct problem of determining the source function caught.

Keywords: Caputo derivative differential equation , exact problem, inverse problem, Cauchy issue , a fixed number.

Let's say $0<\rho<1$ so. We are following

$$D_t^\rho u(x,t)-a^2u_{xx}(x,t)=f(x), \qquad 0<x<l, \quad 0<t<T; \tag{1.1}$$

of a fractional equation in the Caputo sense

$$u(x,+0)=\varphi(x), \qquad 0\le x\le l, \tag{1.2}$$

the initial condition and the following

$$u(0,t)=0, \qquad 0\le t\le T, \tag{1.3}$$

$$u(l,t)=0, \qquad 0\le t\le T, \tag{1.4}$$

a solution that satisfies the boundary conditions to find the issue let's see , here $\varphi(x)$, $f(x)-$ the given functions, $a-$ a constant number , $T-$ a fixed number, D_t^ρ through In Caputo's sense ρ - an ordered fraction is defined as an ordered derivative.

(1.1 **)** - (1.4) **is called *a correct* problem** .

3.1.1 - definition. If $u(x,t)\in C\big([0,l]\times[0,T]\big)$ function the following $D_t^\rho u(x,t)$, $u_{xx}(x,t)\in C\big((0,l)\times(0,T)\big)$ to the property have is , all conditions of (1.1) - (1.4). if satisfied , then this $u(x,t)$ to the function (1.1) - (1.4) ***of the problem the solution*** is called

By finding a solution to this exact problem in the master 's thesis
, the inverse problem of finding the source function is also studied.

Let's assume that in problem (1.1) - (1.4) $u(x,t)$ in addition to the function, $f(x)$ the function is also unknown . To solve this problem we need an additional condition . We get the following condition as an additional condition :

$$u(x,\tau)=\psi(x), \qquad 0<\tau<T. \quad (1.5)$$

In this problem (1.1) - (1.5). $u(x,t)$ and $f(x)$ to the problem of finding functions by finding the right side of the equation is called ***an inverse problem .***

the right problem

The solution of the correct problem for the partial differential equation of order K is shown, that is, the solution of the correct problem (1.1) - (1.4) exists and is proved to be unique.

To solve the problem (1.1) - (1.4), we prove the following theorem.

Theorem 1.1. $\varphi(x)$, $f(x)$ functions continuous , fragmented - continuous to the derivative have and $\varphi(0)=\varphi(l)=0$, $f(0)=f(l)=0$ conditions satisfactory be functions . _ Then the solution of problem (1.1) - (1.4) will be unique and it will look like this :

$$u(x,t)=\sum_{n=1}^{\infty}\left[\varphi_n E_{\rho,1}\left(-\left(\frac{\pi na}{l}\right)^2 t^\rho\right)+\right.$$

$$\left.+f_n t^\rho E_{\rho,\rho+1}\left(-\left(\frac{\pi na}{l}\right)^2 t^\rho\right)\right]\sin\frac{\pi nx}{l}. \quad (1.6)$$

Proof . Theorem to prove for private derivative equations in solving wide spread out of methods one o ' variables separation , that is _ From the Fourier method _ we use (1.1) – (1.4) problem solution

$$u(x,t)=v(x,t)+w(x,t)$$

for a view , here is $v(x,t)$ a function

$$D_t^\rho v(x,t)-a^2 v_{xx}(x,t)=0, \qquad 0<x<l, \quad 0<t<T; \quad (1.7)$$

$$v(x,+0)=\varphi(x), \qquad 0\le x\le l, \quad (1.8)$$

$$v(0,t)=0, \qquad 0\le t\le T, \quad (1.9)$$

$$v(l,t)=0, \qquad 0\le t\le T. \quad (1.10)$$

of the problem, $w(x,t)$ and the function

$$D_t^\rho w(x,t)-a^2 w_{xx}(x,t)=f(x), \qquad 0<x<l, \quad 0<t<T; \quad (1.11)$$

$$w(x,+0)=0, \qquad 0\le x\le l, \quad (1.12)$$

$$w(0,t)=0, \qquad 0\le t\le T, \quad (1.13)$$

$$w(l,t)=0, \qquad 0\le t\le T. \quad (1.14)$$

the solution to the problem.

To solve the problem (1.1) - (1.4), it is enough to solve the above two auxiliary problems.

As we have seen above, in this part, we will solve the problem (1.1) - (1.4) separately for two cases, homogeneous and non-homogeneous .

We use the Fourier method to solve the problem (1.7) – (1.10). The solution

$$v(x,t) = T(t) \cdot X(x) \neq 0 \quad (1.15)$$

we look for in the form , where $X(x)$ - x is a function of only a variable, $T(t)$ and - is a function of only t a variable.

the solution in the form (1.15) into the equation (1.7) and form the following equation:

$$T'(t)X(x) = a^2 T(t)X''(x)$$

Then this of equality two side $T(t) \cdot X(x) \neq 0$ to being to send as a result ,

$$\frac{T'(t)}{a^2 T(t)} = \frac{X''(x)}{X(x)} \quad (1.16)$$

we form the equation. For the function of the form (1.16) to be a solution of the equation (1.7) , from (1.16) consists of to be need , that is $0 < t < T$; manly of variables all in values must be appropriate . (1.13) is the left side of Eq only t to variable , right part only depends on the variable x . If we x change something value choose t variable if we change (1.16) of equality right part and vice versa t of the variable something value choose x variable if we change (1.16), the left part of the equation will be unchanged. This equality holds only if both sides of the equality are equal to a constant number. Therefore, the following equality holds:

$$\frac{T'(t)}{a^2 T(t)} = \frac{X''(x)}{X(x)} = -\lambda \quad (1.17)$$

here λ - is constant, and since there is no requirement for its sign, we take it with a minus sign for the convenience of further calculations.

(1.17) from the equation $X(x)$ and $T(t)$ from scratch to identify different functions

$$T'(t) + \lambda a^2 T(t) = 0 \quad (1.18)$$

$$X''(x) + \lambda X(x) = 0 \quad (1.19)$$

we come to ordinary differential equations.

(1.9) and (1.10), we have the following equality.

$$v(0,t) = T(t) \cdot X(0) = 0$$

$$v(l,t) = T(t) \cdot X(l) = 0$$

we have equalities. Moreover, $T(t)$ for the function since it is a nonzero function $X(x)$

$$X(0) = X(l) = 0 \quad (1.20)$$

It follows that additional conditions are satisfied. Thus, $X(x)$ to define a function, we formulate a simple eigenvalue problem: λ we need to find such values of the parameter as the result

$$\begin{cases} X''(x) + \lambda X(x) = 0 \\ X(0) = X(l) = 0 \end{cases} \quad (1.21)$$

the problem have a nontrivial solution. λ the characteristic value for such values of the parameter, and the corresponding nontrivial solution is called the characteristic function of the given problem . This given eigenvalue and eigenfunction problem is also called the Sturm–Liouville problem. λ of the parameter We will consider the negative , zero and positive cases separately:

1)If $\lambda < 0$ let it be Then the problem of eigenvalue and eigenfunction given by (1. 21) will not have a non-zero solution. We will show it below. The solution $X(x) = e^{kx}$ Let's search in the form , then we will have the following equalities

$$k^2 e^{kx} + \lambda e^{kx} = 0$$

$$k^2 + \lambda = 0$$

$$k = \pm\sqrt{-\lambda}$$

and given of the matter the solution $X(x) = c_1 e^{\sqrt{-\lambda}x} + c_2 e^{-\sqrt{-\lambda}x}$ in appearance will be Now using the boundary conditions

$$\begin{cases} X(0) = c_1 + c_2 = 0 \\ X(l) = c_1 e^{\sqrt{-\lambda}l} + c_2 e^{-\sqrt{-\lambda}l} = 0 \end{cases}$$

we get the system and solve it:

$$\begin{cases} c_2 = -c_1 \\ c_1 e^{\sqrt{-\lambda}l} - c_1 e^{-\sqrt{-\lambda}l} = 0 \end{cases}$$

$l \neq 0$ va $e^{\sqrt{-\lambda}l} - e^{-\sqrt{-\lambda}l} \neq 0$ from $c_1 = 0$ and $c_2 = 0$ that we find So , if $\lambda < 0$ if (3.1.18) problem $X(x) = 0$ to the solution have it is

2)If $\lambda = 0$ let it be Then the given eigenvalue and eigenfunction problem (1.21) will not have a non-zero solution. If $\lambda = 0$ indeed _ _ $X''(x) = 0$ to Eq have we will be , from this $X(x) = c_1 x + c_2$ to the solution we arrive at , if we use the boundary conditions

$$\begin{cases} X(0) = c_1 \cdot 0 + c_2 = 0 \\ X(l) = c_1 \cdot l + c_2 = 0 \end{cases} \Rightarrow \quad c_2 = 0 \text{ and } l \neq 0 \text{ from } c_1 = 0.$$

So , if $\lambda = 0$ if , (3.1.21) is the problem $X(x) = 0$ to the solution have it is

3)If $\lambda > 0$ let it be Then the given eigenvalue and eigenfunction problem (1.21) will have a non-zero solution. If $\lambda > 0$ indeed if so , the solution $X(x) = e^{kx}$ in appearance let's look for , then we will have the following equalities

$$k^2 e^{kx} + \lambda e^{kx} = 0$$

$$k^2 + \lambda = 0$$

$$k = \pm i\sqrt{\lambda}$$

and $e^{i\sqrt{\lambda}x} = \cos\sqrt{\lambda}x \pm i\sin\sqrt{\lambda}x$ that account if we get , it is given of the matter the solution $X(x) = A\cos\sqrt{\lambda}x + B\sin\sqrt{\lambda}x$ in the form will be According to the boundary conditions

$$\begin{cases} X(0) = A\cos\left(\sqrt{\lambda}\cdot 0\right) + B\sin\left(\sqrt{\lambda}\cdot 0\right) = A = 0 \\ X(l) = A\cos\left(l\sqrt{\lambda}\right) + B\sin\left(l\sqrt{\lambda}\right) = 0 \end{cases}$$

will be From this $X(l)=B\sin\left(l\sqrt{\lambda}\right)=0$ will be , $X(x)\neq 0$to be for $B\neq 0$ to be need _ In that case $\sin\left(l\sqrt{\lambda}\right)=0$ or $\sqrt{\lambda}=\frac{\pi n}{l}$, this on the ground because n= 1,2,3,... λ and l positive numbers . So , the given problem is non-trivial to the solution $\lambda=\lambda_n=\left(\frac{\pi n}{l}\right)^2$ special only in values have and it will be as follows

$$X_n(x)=B_n\sin\frac{\pi nx}{l} \tag{1.22}$$

The solution is if we choose an arbitrary constant coefficient as one

$$X_n(x)=\sin\frac{\pi nx}{l} \tag{1.23}$$

will appear.

Now and , $\lambda_n=\left(\frac{\pi n}{l}\right)^2$ characteristic to value suitable special function $T_n(t)$ s for the following expressions we find :

$$v(x,t)=\sum_{n=1}^{\infty}T_n(t)\cdot\sin\frac{\pi nx}{l} \tag{1.24}$$

If we transfer the expression (1.24) to the problem (1.7), the following equality is formed:

$$\sum_{n=1}^{\infty}D_t^{\rho}T_n(t)\cdot\sin\frac{\pi nx}{l}+a^2\sum_{n=1}^{\infty}\left(\frac{\pi n}{l}\right)^2T_n(t)\cdot\sin\frac{\pi nx}{l}=0.$$

From this,

$$\sum_{n=1}^{\infty}\left[D_t^{\rho}T_n(t)+a^2\left(\frac{\pi n}{l}\right)^2T_n(t)\right]\cdot\sin\frac{\pi nx}{l}=0$$

we form the equation. So we come to the following issue:

$$\begin{cases}D_t^{\rho}T_n(t)+a^2\left(\frac{\pi n}{l}\right)^2T_n(t)=0,\\ T_n(+0)=\varphi_n,\end{cases} \tag{1.25}$$

(3.1.25) The solution of the Cauchy problem is, by virtue of (2.2.14), the following (see [Kilbas]):

$$T_n(t)=\varphi_nE_{\rho,1}\left(-\left(\frac{\pi na}{l}\right)^2t^{\rho}\right). \tag{1.26}$$

Since the sum of particular solutions is a solution

$$v(x,t)=\sum_{n=1}^{\infty}T_n(t)\cdot X_n(t)$$

function is also a solution. So (1.7) – (1.10) is a formal solution of the problem

$$v(x,t)=\sum_{n=1}^{\infty}\varphi_n E_{\rho,1}\left(-\left(\frac{\pi na}{l}\right)^2 t^{\rho}\right)\sin\frac{\pi nx}{l} \quad (1.27)$$

will appear.

Now we show that this series is flat convergent. For this, the partial sum of the series (1.27).

$$V_j(x,t)=\sum_{n=1}^{j}\varphi_n E_{\rho,1}\left(-\left(\frac{\pi na}{l}\right)^2 t^{\rho}\right)\sin\frac{\pi nx}{l}$$

we define as

If the Mittag–Leffler function

$$|E_{\rho,\mu}(-z)|\leq\frac{1}{1+z}$$

from the estimate, (1.27) results in smooth convergence of the series.

$v_{xx}(x,t)$ of flat approachability

$$\frac{\partial^2}{\partial x^2}V_j(x,t)=\sum_{n=1}^{\infty}\varphi_n\left(\frac{\pi n}{l}\right)^2 E_{\rho,1}\left(-\left(\frac{\pi na}{l}\right)^2 t^{\rho}\right)\sin\frac{\pi nx}{l}$$

at

$$\left(\frac{\pi n}{l}\right)^2 E_{\rho,1}\left(-\left(\frac{\pi na}{l}\right)^2 t^{\rho}\right)\leq 1$$

price and $\varphi(x)$ of the function properties soon come comes out

In addition, $D_t^{\rho}v(x,t)-a^2v_{xx}(x,t)=0$ it follows that the equality (1.11) $D_t^{\rho}v(x,t)\in C((0,l)\times(0,T))$, So, $t>0$ it follows from the above considerations that the function (1.27) is a solution to the problem (1.11) - (1.14).

In addition, $D_t^{\rho}V_j(x,t)=\frac{\partial^2}{\partial x^2}V_j(x,t)$ it follows that the equality (1.7) $D_t^{\rho}v(x,t)\in C((0,l)\times(0,T))$, So, $t>0$ it follows from the above considerations that the function (1.27) is a solution of the problem (1.7) - (1.10).

Now let's look at the non-homogeneous case. (1.11) – (1.14) and Fourier to solve the problem method we use , that is $w(x,t)$ function

$$w(x,t)=\sum_{n=1}^{\infty}T_n(t)\cdot\sin\frac{\pi nx}{l}$$

apparently _ _ we are looking for Him (1.11) to Eq take go let 's put and to simplify the following equality harvest we do :

$$D_t^{\rho}T_n(t)+a^2\left(\frac{\pi n}{l}\right)^2 T_n(t)=f_n(x).$$

initial condition account if we get $T_n(+0)=0$ condition harvest we do So the following

$$\begin{cases} D_t^\rho T_n(t) + a^2\left(\frac{\pi n}{l}\right)^2 T_n(t) = f_n(x), \\ T_n(+0) = 0, \end{cases} \quad (1.28)$$

let's get to the point. Solving it, we get the following formal solution (see [Kielbas])

$$T_n(t) = \int_0^t \eta^{\rho-1} E_{\rho,\rho}\left(-\lambda_n \eta^\rho\right) f_n(\text{t}-\eta) d\eta \,. \quad (1.29)$$

If $f(x)$ function t Given that does not depend on , then

$$\int_0^t \eta^{\rho-1} E_{\rho,\rho}\left(-\lambda_n \eta^\rho\right) f_n(\text{t}-\eta) d\eta = f_n \int_0^t \eta^{\rho-1} E_{\rho,\rho}\left(-\lambda_n \eta^\rho\right) d\eta$$

we form the equation. If

$$\int_0^t \eta^{\rho-1} E_{\rho,\rho}\left(-\lambda_n \eta^\rho\right) d\eta = t^\rho E_{\rho,\rho+1}\left(-\lambda_n t^\rho\right)$$

taking into account the situation, then we obtain the following solution for the problem (3.1.28):

$$T_n(t) = f_n t^\rho E_{\rho,\rho+1}\left(-\left(\frac{\pi n a}{l}\right)^2 t^\rho\right).$$

Thus, we have the following formal solution to problem (1.11)–(1.14):

$$w(x,t) = \sum_{n=1}^{\infty} f_n t^\rho E_{\rho,\rho+1}\left(-\left(\frac{\pi n a}{l}\right)^2 t^\rho\right) \cdot \sin\frac{\pi n x}{l} \,. \quad (1.30)$$

Now we show that this series is flat convergent. For this, the partial sum of the series (1.30).

$$W_j(x,t) = \sum_{n=1}^{j} f_n t^\rho E_{\rho,\rho+1}\left(-\left(\frac{\pi n a}{l}\right)^2 t^\rho\right) \cdot \sin\frac{\pi n x}{l}$$

we define as If the Mittag–Leffler function

$$|E_{\rho,\mu}(-z)| \le \frac{1}{1+z}$$

from the estimate, (1.30) results in smooth convergence of the series. $w_{xx}(x,t)$ of flat approachability

$$\frac{\partial^2}{\partial x^2} W_j(x,t) = \sum_{n=1}^{j} f_n \left(\frac{\pi n}{l}\right)^2 t^\rho E_{\rho,\rho+1}\left(-\left(\frac{\pi n a}{l}\right)^2 t^\rho\right) \cdot \sin\frac{\pi n x}{l}$$

at

$$\left(\frac{\pi n}{l}\right)^2 E_{\rho,\rho+1}\left(-\left(\frac{\pi n a}{l}\right)^2 t^\rho\right) \le 1$$

price and $f(x)$ of the function properties soon come comes out

Moreover, equality (1.11) $D_t^{\rho} W_j(x,t) = \frac{\partial^2}{\partial x^2} W_j(x,t) + \sum_{k=1}^{j} f_k(t) \sin\frac{\pi n x}{l}, \ t > 0$ it follows that from So, $D_t^{\rho} w(x,t) \in C((0,l)\times(0,T))$ it follows from the above considerations that the function (1.30) is a solution to the problem (1.11) - (1.14).

Summarizing these solutions, we get the following solution for problem (1.7) - (1.10) :

$$u(x,t) = v(x,t) + w(x,t) = \sum_{n=1}^{\infty} \varphi_n E_{\rho,1}\left(-\left(\frac{\pi n a}{l}\right)^2 t^{\rho}\right) \sin\frac{\pi n x}{l} +$$

$$+\sum_{n=1}^{\infty} f_n t^{\rho} E_{\rho,\rho+1}\left(-\left(\frac{\pi n a}{l}\right)^2 t^{\rho}\right) \cdot \sin\frac{\pi n x}{l} . \quad (1.31)$$

Thus , by the formula (1.6) . determined $u(x,t)$ function (1.7) - (1.10) will be the solution of the problem .

List of used literature.

1. qizi Latipova, S. S. (2023). RIMAN-LUIVILL KASR TARTIBLI INTEGRALI VA HOSILASIGA OID AYRIM MASALALARNING ISHLANISHI. *Educational Research in Universal Sciences*, *2*(12), 216-220.
2. qizi Latipova, S. S. (2023). MITTAG–LIFFLER FUNKSIYASI VA UNI HISOBLASH USULLARI. *Educational Research in Universal Sciences*, *2*(9), 238-244.
3. Shahnoza, L. (2023, March). KASR TARTIBLI TENGLAMALARDA MANBA VA BOSHLANG'ICH FUNKSIYANI ANIQLASH BO'YICHA TESKARI MASALALAR. In *" Conference on Universal Science Research 2023"* (Vol. 1, No. 3, pp. 8-10).
4. Jurakulov, S. Z. (2023). NUCLEAR ENERGY. *Educational Research in Universal Sciences*, *2*(10), 514-518.
5. qizi Latipova, S. S. (2023). RIMAN-LUIVILL KASR TARTIBLI INTEGRALI VA HOSILASIGA OID AYRIM MASALALARNING ISHLANISHI. *Educational Research in Universal Sciences*, *2*(12), 216-220.
6. qizi Latipova, S. S. (2023). MITTAG–LIFFLER FUNKSIYASI VA UNI HISOBLASH USULLARI. *Educational Research in Universal Sciences*, *2*(9), 238-244.
7. Oghly, J. S. Z. (2023). PHYSICO-CHEMICAL PROPERTIES OF POLYMER COMPOSITES. *American Journal of Applied Science and Technology*, *3*(10), 25-33.
8. Zafarjon o'g'li, Z. S. (2023). PHYSICAL-MECHANICAL PROPERTIES OF INTERPOLYMER COMPLEX FILM BASED ON SODIUM CARBOXYMETHYL CELLULOSE AND POLYACRYLAMIDE.
9. Oghly, J. S. Z. (2023). THE RELATIONSHIP OF PHYSICS AND ART IN ARISTOTLE'S SYSTEM. *International Journal of Pedagogics*, *3*(11), 67-73.

10. Sharipova, M. P. L. (2023). CAPUTA MA'NOSIDA KASR TARTIBLI HOSILALAR VA UNI HISOBLASH USULLARI. *Educational Research in Universal Sciences*, *2*(9), 360-365.
11. ГОСТAxmedova Z. I. LMS TIZIMIDA INTERAKTIV ELEMENTLARNI YARATISH TEXNOLOGIYASI //Educational Research in Universal Sciences. – 2023. – Т. 2. – №. 10. – С. 368-372.
12. MLA.Axmedova, Zulxumor Ikromovna. "LMS TIZIMIDA INTERAKTIV ELEMENTLARNI YARATISH TEXNOLOGIYASI." *Educational Research in Universal Sciences* 2.10 (2023): 368-372.
13. APAAxmedova, Z. I. (2023). LMS TIZIMIDA INTERAKTIV ELEMENTLARNI YARATISH TEXNOLOGIYASI. *Educational Research in Universal Sciences*, *2*(10), 368-372.
14. Boboqulova, M. X. (2023). STOMATOLOGIK MATERIALLARNING FIZIK-MEXANIK XOSSALARI. *Educational Research in Universal Sciences*, *2*(9), 223-228.
15. Муродов, О. Т. (2023). РАЗРАБОТКА АВТОМАТИЗИРОВАННОЙ СИСТЕМЫ УПРАВЛЕНИЯ ТЕМПЕРАТУРЫ И ВЛАЖНОСТИ В ПРОИЗВОДСТВЕННЫХ КОМНАТ. *GOLDEN BRAIN*, *1*(26), 91-95.
16. Murodov, O. T. R. (2023). ZAMONAVIY TA'LIMDA AXBOROT TEXNOLOGIYALARI VA ULARNI QO 'LLASH USUL VA VOSITALARI. *Educational Research in Universal Sciences*, *2*(10), 481-486.
17. qizi Sharopova, M. M. (2023). RSA VA EL-GAMAL OCHIQ KALITLI SHIFRLASH ALGORITMI ASOSIDA ELEKTRON RAQMLI IMZOLARI. RSA OCHIQ KALITLI SHIFRLASH ALGORITMI ASOSIDAGI ELEKTRON RAQAMLI IMZO. Educational Research in Universal Sciences, 2(10), 316-319.
18. Sharipova, M. P. L. (2023). CAPUTA MA'NOSIDA KASR TARTIBLI HOSILALAR VA UNI HISOBLASH USULLARI. *Educational Research in Universal Sciences*, *2*(9), 360-365.
19. Sharipova, M. P. (2023). MAXSUS SOHALARDA KARLEMAN MATRITSASI. *Educational Research in Universal Sciences*, *2*(10), 137-141.
20. Madina Polatovna Sharipova. (2023). APPROXIMATION OF FUNCTIONS WITH COEFFICIENTS. *American Journal of Public Diplomacy and International Studies (2993-2157)*, *1*(9), 135–138.
21. Madina Polatovna Sharipova. (2023). Applications of the double integral to mechanical problems. International journal of sciearchers,2(2), 101-103.
22. Oghly, J. S. Z. (2023). BASIC PHILOSOPHICAL AND METHODOLOGICAL IDEAS IN THE EVOLUTION OF PHYSICAL SCIENCES. *Gospodarka i Innowacje.*, *41*, 233-241.
23. Jurakulov Sanjar Zafarjon Oghly. (2023). A Japanese approach to in-service training and professional development of science and physics teachers in Japan . *American Journal of Public Diplomacy and International Studies (2993-2157)*, *1*(9), 167–173.

24. Jurakulov , S. Z. ugli. (2023). FIZIKA TA’LIMI MUVAFFAQIYATLI OLISH UCHUN STRATEGIYALAR. *Educational Research in Universal Sciences*, *2*(14), 46–48.

25. Турсунов, Б. Ж., & Шомуродов, А. Ю. (2021). Перспективный метод утилизации отходов нефтеперерабатывающей промышленности. TA'LIM VA RIVOJLANISH TAHLILI ONLAYN ILMIY JURNALI, 1(6), 239-243.
26. Bakhodir, T., Bakhtiyor, G., & Makhfuza, O. (2021). Oil sludge and their impact on the environment. Universum: технические науки, (6-5 (87)), 69-71.
27. Турсунов, Б. Ж. (2021). АНАЛИЗ МЕТОДОВ УТИЛИЗАЦИИ ОТХОДОВ НЕФТЕПЕРЕРАБАТЫВАЮЩЕЙ ПРОМЫШЛЕННОСТИ. Scientific progress, 2(4), 669-674.

28. ТУРСУНОВ, Б., & ТАШПУЛАТОВ, Д. (2018). ЭФФЕКТИВНОСТЬ ПРИМЕНЕНИЯ ПРЕДВАРИТЕЛЬНОГО ОБОГАЩЕНИЯ РУД В КАРЬЕРЕ КАЛЬМАКИР. In Инновационные геотехнологии при разработке рудных и нерудных месторождений (pp. 165-168).

29. Турсунов, Б. Д., & Суннатов, Ж. Б. (2017). Совершенствование технологии вторичного дробления безвзрывным методом. Молодой ученый, (13), 97-100.

Турсунов, Б. Ж., Ботиров, Т. В., Ташпулатов, Д. К., & Хайруллаев, Б. И. (2018). ПЕРСПЕКТИВА ПРИМЕНЕНИЯ ОПТИМАЛЬНОГО ПРОЦЕССА РУДООТДЕЛЕНИЯ В КАРЬЕРЕ МУРУНТАУ. In Инновационные геотехнологии при разработке рудных и нерудных месторождений (pp. 160-164).