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CONTENT

CHEMISTRY

Enukidze L., Loladze T.

STUDY OF THE CONTENT OF SOME HEAVY METALS IN
THE HAIR OF EMPLOYEES OF ONE OF THE CHEMICAL
INSTITUTES OF TBILISI 3

COMPUTER SCIENCE

Al-Ammouri Ali, Shkurko O.,

Dekhtyar M., Zavorotnyi S.

SOME PROBLEMS OF ECONOMIC OPTIMIZATION OF
STRUCTURES INFORMATION-CONTROL SYSTEMS 7

EARTH SCIENCES

Deryaev A.

MEASURES FOR THE OPERATION OF WELLS BY THE
GAS LIFT METHOD AND PREPARATION,
TRANSPORTATION OF NATURAL AND ASSOCIATED
GAS AT GAS CONDENSATE FIELDS 13

ELECTRICAL ENGINEERING

Bruj N.

METHODS OF FORECASTING THE PRODUCTION OF
SOLAR MODULES AND BATTERIES BASED ON
METEOROLOGICAL DATA 22

MATHEMATICS

Djumaniyazova Kh., Khashimov A.

BOUNDARY VALUE PROBLEM FOR THE THIRD-ORDER
EQUATION WITH MULTIPLE CHARACTERISTICS 29

PEDAGOGY

Livatsky O., Livatska S.

THE PROBLEM OF ORGANIZING INDEPENDENT
PHYSICAL EDUCATION OF HIGHER EDUCATION
ACQUISITIONS UNDER THE CONDITIONS OF MARITAL
STATE 32

PHILOSOPHY

Kadaner O., Moshynska O.

DEVELOPMENT OF JOURNALISM IN THE
PHILOSOPHICAL SPACE 35

SOCIAL COMMUNICATION STUDIES

Mounir Antonious Samir

AN OVERVIEW ON THE DEVELOPMENT OF
ADVERTISING IN EGYPT, THE UK, AND BELARUS 40

CHEMISTRY

ИССЛЕДОВАНИЕ СОДЕРЖАНИЯ НЕКОТОРЫХ ТЯЖЕЛЫХ МЕТАЛЛОВ В ВОЛОСАХ СОТРУДНИКОВ ОДНОГО ИЗ ХИМИЧЕСКИХ ИНСТИТУТОВ г. ТБИЛИСИ

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Аннотация

Методом дифференциально-импульсной полярографии определено содержание некоторых тяжелых металлов в волосах сотрудников одного из химических институтов г.Тбилиси. Установлено, что почти во всех образцах содержание меди ниже нормы, установленной Всемирной организацией здравоохранения. Содержание свинца во всех образцах не превышает предельно допустимую концентрацию. Кадмий лишь в одном образце превышает предельно допустимую концентрацию. Содержание цинка почти во всех образцах выше нормы.

Abstract

The content of some heavy metals in the hair of employees of one of the chemical institutes in Tbilisi was determined by the method of differential-pulse polarography. It has been established that in almost all samples the copper content is below the norm established by the World Health Organization. The lead content in all samples does not exceed the maximum allowable concentration. Cadmium in only one sample exceeds the maximum allowable concentration. The zinc content in almost all samples is above the norm.

Ключевые слова: тяжелые металлы, волосы, здоровье, дифференциальная импульсная полярография, предельно допустимая концентрация.

Keywords: heavy metals, hair, health, differential pulse polarography, maximum allowable concentration.

В последние годы все больший интерес для выявления состояния обмена элементов в организме человека и влияния тяжелых металлов представляет исследование волос человека. Волосы являются наиболее доступным субстратом для такого рода исследований, а взятие проб является простым и безболезненным. Тяжелые металлы, попадающие в волосы в процессе их роста, не удаляются из них в дальнейшем, так как они обладают способностью накапливаться в организме человека. Содержание тяжелых металлов в волосах и других биологических средах в первую очередь зависит от фактического содержания их в рационе питания, а также от длительного контакта с этими элементами, например, на химическом производстве. Состав волос достаточно полно отражает содержание тяжелых металлов в организме человека [1-3].

Питательным источником растущих волос является кровь, которая содержит следы всего, что попадает в организм человека. Вещества, единожды включившись в обменный процесс, не вступают в обратную связь с организмом, откладываются в нем, оставляя «архив» для ретроспективного анализа жизнедеятельности организма в интересующий исследователя промежуток времени. Именно поэтому химический анализ волос в последние годы получил широкое распространение [4-7].

В организме человека содержатся практически все элементы из таблицы Менделеева. Некоторые из них представлены в огромных количествах, например, углерод, водород. Металлы также играют в жизнедеятельности человека важную роль, примером таких металлов являются медь, цинк, железо и т.д.

Некоторые тяжелые металлы определяются в организме в следовых количествах и не участвуют в обменных процессах. При превышении определенной концентрации ряда микроэлементов может развиваться отравление, которое способно привести к тяжелейшим осложнениям и даже к летальному исходу. Чаще всего накопление тяжелых металлов наблюдается в организме людей, непосредственно работающих с источниками этих элементов.

Поэтому представлял особый интерес проведение мониторинга содержания некоторых тяжелых металлов, в частности, меди, свинца, кадмия и цинка, в волосах сотрудников одного из химических институтов г.Тбилиси.

Измерения проводили на полярографе ПУ-1 в режиме дифференциально-импульсной полярографии с ртутным капельным электродом по трехэлектродной схеме в термостатированной ячейке.

Анализ меди (II), свинца (II), кадмия (II) и цинка (II) проводили по ранее нами разработанной методике [8]. Содержание микроэлементов в волосах человека определяли по сухому остатку в пересчете на 1г волос.

Всего нами был проведен анализ 35 образцов волос. В таблице 1 приведены результаты по содержанию перечисленных выше микроэлементов в пробах волос человека.

Таблица 1.

Результаты определения содержания Cu(II), Pb(II), Cd(II), Zn(II) в волосах сотрудников института г.Тбилиси.

образец #	Содержание металлов, мкг/г			
	Cu	Pb	Cd	Zn
1	3.50	0.35	0.29	343.93
2	7.06	0.68	0.56	437.91
3	2.73	0.33	0.23	359.98
4	4.18	0.00	0.00	319.70
5	1.53	0.12	0.00	153.84
6	5.23	0.00	0.00	303.53
7	4.95	0.00	0.00	330.40
8	13.53	0.00	0.00	503.75
9	5.28	0.00	0.00	377.86
10	3.39	0.00	0.00	354.38
11	3.30	0.00	0.00	340.50
12	6.39	0.00	0.00	278.52
13	5.76	0.00	0.00	251.33
14	4.38	0.00	0.00	454.83
15	6.09	0.37	0.38	353.41
16	7.25	0.29	0.00	375.11
17	4.47	0.00	0.00	386.03
18	4.61	0.00	0.00	441.16
19	5.60	0.52	0.30	272.35
20	5.40	0.00	0.00	329.83
21	3.50	1.08	0.00	122.26
22	4.29	0.02	0.01	368.77
23	5.80	0.10	1.46	337.40
24	5.19	3.33	0.00	225.97
25	5.92	0.68	0.56	382.45
26	9.01	2.55	0.00	489.10
27	3.43	0.00	0.00	393.86
28	4.05	0.61	0.94	372.56
29	4.14	0.00	0.00	473.62
30	5.95	0.72	0.56	353.80
31	3.74	0.39	0.02	383.59
32	4.94	0.52	0.43	138.28
33	2.88	0.50	0.20	199.92
34	3.20	0.00	0.00	163.87
35	5.70	0.00	0.00	260.00

В таблице 2 представлены, установленные Всемирной организацией здравоохранения (ВОЗ) данные по содержанию в волосах человека меди, свинца, кадмия и цинка.

Таблица 2.

Данные ВОЗ 1996г.

Металл	Волосы, мкг/г
Медь	9-30
Свинец	0-5,0
Кадмий	0-1,0
Цинк	120-200

Из таблицы 1 видно, что из 35 образцов в 32-х содержание меди колеблется в интервале 1,53-7,25 мкг/г, а это ниже физиологической нормы (9мкг/г). И только в двух образцах волос - составляет норму. Свинец в 17 образцах волос отсутствует вообще. В остальных пробах его значение колеблется от 0,1-3,35 мкг/г, что не превышает предельно допустимую концентрацию (5мкг/г). Следует отметить, что максимальное значение свинца - 3,35 мкг/г наблюдается у сотрудника, непосредственно работающего со свинцовыми электродами.

Что касается кадмия, он в незначительных количествах (не превышает предельно допустимую концентрацию 1 мкг/г) обнаружен в 11 образцах волос. И только в одной пробе несколько превышает предельно допустимую концентрацию (1,46 мкг/г). Как оказалось этот сотрудник приблизительно 10 лет тому назад работал с веществами, содержащими ионы кадмия (кадмий имеет отчетливую тенденцию к накоплению – период его полувыведения из организма составляет 10-35 лет) и к тому же был курящим.

Из данных табл. 1 видно, что содержание цинка в 30 образцах волос превышает верхнюю границу физиологической нормы (250 мкг/г). Такое высокое значение цинка, вероятно, объясняется

тем, что анализ волос проводился во время пандемии Covid-19, и многие люди в то время принимали специальные препараты, содержащие цинк. Столь высокое содержание цинка в образцах волос может объяснить низкое содержание меди почти во всех образцах, поскольку известно, что цинк и медь являются антагонистами друг друга. Это означает, что если значение одного из них слишком велико, уровень другого в организме будет низким, и наоборот. Таким образом, важно поддерживать оптимальные уровни и соотношения этих двух микроэлементов [9].

Как уже было отмечено выше, эксперимент был проведен во время пандемии Covid-19. Так что, полученные данные по меди и цинку были вполне ожидаемы. Кроме того, еще раз была подтверждена зависимость тяжелых металлов таких как, например, свинец и кадмий, от длительного контакта с ними.

В качестве иллюстраций, полученных нами экспериментальных данных, приведены рисунки 1 и 2. На рис.1 показано содержание меди в волосах, ниже указанной ВОЗ-ом нормы ($C_{Cu}=2,75$ мкг/г), на рис.2 - содержание цинка выше нормы ($C_{Zn}=340,5$ мкг/г).

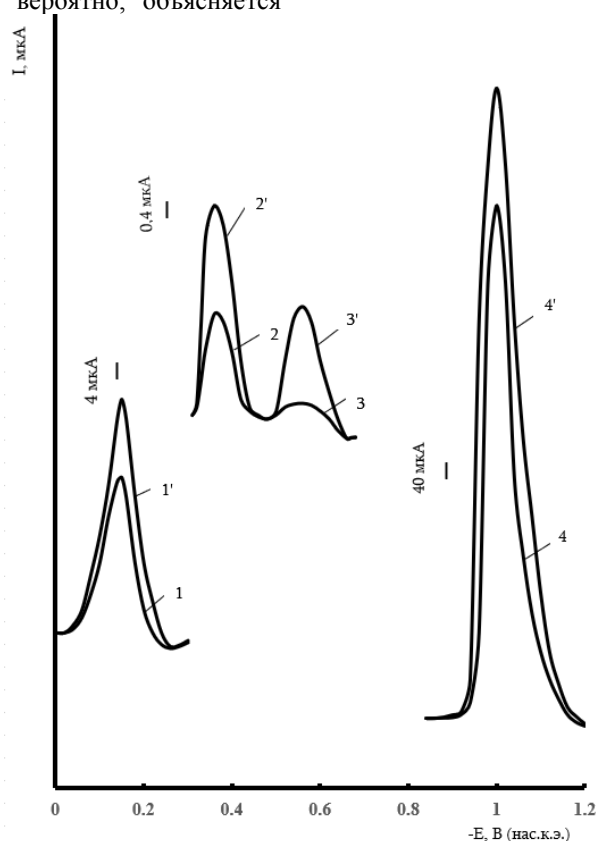


Рис.1: Поларограммы ионов меди, свинца, кадмия и цинка в 1 г волос человека в 0,1М растворе HCl: 1 – Cu(II); 2 – Pb(II); 3 – Cd(II); 4 – Zn(II); 1', 2', 3' и 4' - соответствующие стандарты.

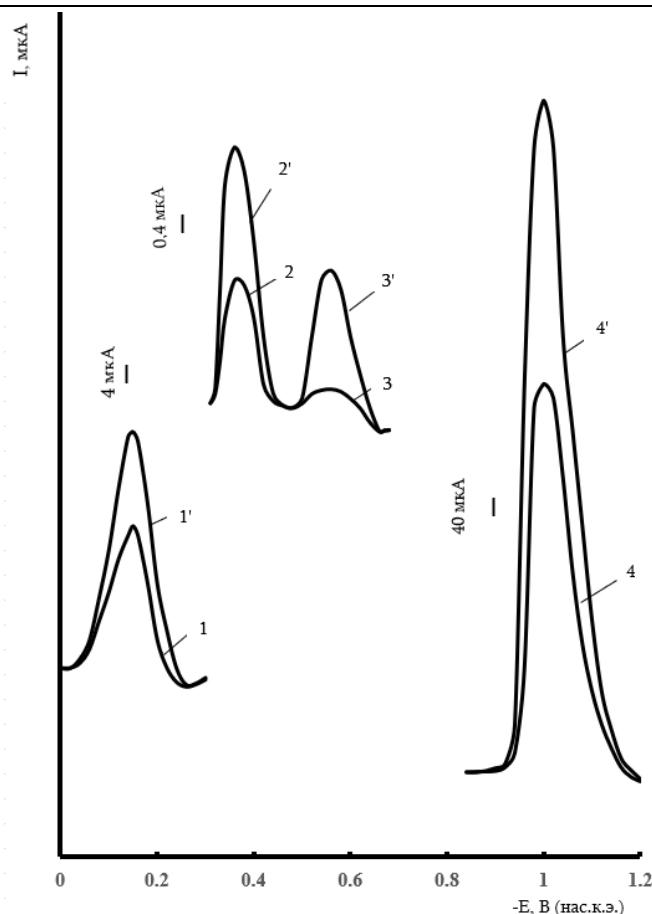


Рис.2: Полярограммы ионов меди, свинца, кадмия и цинка в 1 г волос человека в 0,1М растворе HCl: 1 – Cu(II); 2 – Pb(II); 3 – Cd(II); 4 – Zn(II); 1', 2', 3' и 4' - соответствующие стандарты.

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COMPUTER SCIENCE

ДЕЯКІ ПРОБЛЕМИ ЕКОНОМІЧНОЇ ОПТИМІЗАЦІЇ СТРУКТУР ІНФОРМАЦІЙНО-УПРАВЛЯЮЧИХ СИСТЕМ

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SOME PROBLEMS OF ECONOMIC OPTIMIZATION OF STRUCTURES INFORMATION-CONTROL SYSTEMS

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Анотація

У статті розглядається актуальне завдання оптимального вибору практично вживаних структур систем масового обслуговування з урахуванням економічної доцільності їх застосування. Вирішується проблема вибору і створення оптимальних структур систем масового обслуговування в організаціях та установах, які обслуговують споживачів.

Abstract

In article the actual problem of optimum choice of almost applied structures of systems of mass service taking into account economic feasibility of their application is considered. The problem of a choice and creation of optimum structures of systems of mass service in the organizations and establishments which serve consumers dares.

Ключові слова: інформаційно-управляючі системи, локальні комп'ютерні мережі, системи масового обслуговування, ймовірність необслуговування.

Keywords: information and management systems, local computer networks, mass service systems, probability of non-service.

Вступ

В інформаційно-управляючих системах часто зустрічаються задачі організації оптимальної структури систем зв'язку, багатоканальної обробки та передачі інформації, що надходить дискретно певними частинами за випадковим законом в локальні комп'ютерні системи.

Крім того, в умовах ринкових відносин виникають задачі вибору та організації оптимальної структури управління виробничих, ремонтних майстерень, у тому числі на транспорті (авіаційному, морському автомобільному, залізничному), організацій та установ, що обслуговують споживачів, а також наукових бібліотек ВНЗ, а безпосередньо в них багатоканальних та багатofазних систем масового обслуговування (СМО), де заявки на обслуговування надходять випадково [1].

У перерахованих задачах завжди існують дві основні суперечливі вимоги:

1. Максимальне використання виробничих ресурсів, зниження до мінімуму часу їх простою.
2. Мінімальні втрати у заявках, що надходять на обслуговування, або їх тимчасових затримках у чергах.

Виконання зазначених двох вимог можна звести до задачі вибору такої оптимальної структури багатоканальної та багатofазної системи масового обслуговування, яка б забезпечила максимальну пропускну здатність за мінімальних економічних витрат.

Загалом, теоретичному плані така задача є дуже складна, і не завжди вдається знайти її чітке математичне обґрунтування.

У цій статті пропонується методика спрощеного аналізу пропускну спроможності багатоканальних багатofазних систем масового обслуговування з задалегідь заданою певною похибкою оцінок порівняно з класичними методами дослідження [2]. Такий підхід можна вважати виправданим за певних випадків. Особливо це стосується багатofазних СМО, в яких пропускну здатність, що оцінюється ймовірністю обслуговування, є нелінійною функцією від інтенсивності заявок на обслуговування, що надходять.

Виклад основних результатів

Лінеаризація завдань оцінки пропускну спроможності багатоканальних та багатofазних систем дозволяє виключити проблеми нелінійності та за допомогою спрощених розрахунків обґрунтувати її структуру, близьку до оптимальної з деякою допустимою похибкою.

Цей метод є актуальним у наш час, коли повсякденно виникають нагальні проблеми вибору та організації оптимальної структури офісу, виробничих, ремонтних майстерень, у тому числі на транспорті (авіаційному, морському автомобільному, залізничному), організацій установ, що обслуговують споживачів, у тому числі наукових бібліотек ВНЗ, а безпосередньо в них багатоканальної системи зв'язку та управління, що працює в реальному часі.

Даний метод може бути застосований до таких видів додаткових платних послуг, які є в багатьох

наукових бібліотеках ВНЗ, а саме робота комп'ютерних класів та ксероксу. Дуже важливо, з одного боку, забезпечити швидке та якісне обслуговування користувачів, а з іншого, уникнути зайвих витрат на утримання працівників, які займаються даними послугами.

Як правило, заявки на обслуговування надходять випадково за пуассонівським законом розподілу ймовірностей, а ймовірність P_{n0ij} не обслужених заявок i -го каналу на j -й фазі визначається залежністю:

$$P_{n0ij} = 1 - e^{-\chi_{ij} t_{ij}}, \quad (1)$$

де χ_{ij} – інтенсивність надходження заявок на j -у фазу по i -ому каналу.

Оскільки заявки на j -у фазу по i -ому каналу надходять з $j-1$ -ої фази, їх інтенсивність χ_{ij} буде знижена за рахунок втрат заявок на $j-1$ -й фазі і буде визначатись залежністю:

$$\chi_{ij} = \chi_{(ij-1)} e^{-\chi_{(ij-1)} t_{(ij-1)}} \quad (2)$$

Таким чином, чітке визначення ймовірності P_{n0ij} за виразом (1) вимагає враховувати зниження інтенсивності попередніх фаз відповідно до формули (2). Виходячи з цього можна зробити висновок, що задача оцінки пропускну спроможності в загальному випадку є нелінійним і чітко, або взагалі не може бути вирішено, або вирішується за допомогою дуже складного та громіздкого математичного апарату.

Забезпечення мінімально допустимого значення ймовірності P_{n0} не обслуговування заявок при збільшенні їх інтенсивності χ_i можливо досягнути шляхом зменшення a_i часу обслуговування заявок.

Остання дія пов'язана з нарощуванням виробничих потужностей та додатковими економічними витратами на розширення виробництва.

Введемо поняття похідної матриці Π . В загальному вигляді для m -канальної та m -фазної системи це буде квадратна матриця розмірністю $m \times m$. В загальному вигляді матриця Π буде мати вигляд [3]:

$$\Pi = \begin{vmatrix} n_{11} & n_{12} & n_{13} \\ n_{21} & n_{22} & n_{23} \\ n_{31} & n_{32} & n_{33} \end{vmatrix} \quad (3)$$

Цілочислові елементи матриці (3) визначають кількість робочих міст в i -ом каналі на j -й фазі.

Також введемо поняття вектора R вартості робіт, складові r_i якого будуть визначати вартість

робіт по j -й фазі. Тоді загальна вартість R_C може бути визначена наступною матричною залежністю:

$$R_C = R_1^T \cdot \Pi \cdot R, \quad (4)$$

де R_1^T - одиничний транспортований вектор.

Вираз (4) визначає економічні витрати, на підвищення пропускної спроможності СМО шляхом зменшення часу обслуговування заявок.

Відповідно до [4], загальний дохід D системи з урахуванням втрат заявок обслуговування визначається виразом:

$$D = \sum_{i=1}^n y_i - Y^T A \cdot X \quad (5)$$

де Y^T - вектор-строка інтенсивностей y_i надходження заявок з врахуванням їх оплати за обслуговування; X - вектор-стовпець інтенсивностей x_i заявок, які надходять на обслуговування багатоканальної та багатофазної СМО; A - квадратна матриця, елементи a_{ij} якої визначають в

$$\Pi = \begin{vmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{vmatrix}; \quad R = \begin{vmatrix} 2.5 \\ 5 \\ 3.5 \end{vmatrix}; \quad A = \begin{vmatrix} 0.002 & 0 & 0 \\ 0 & 0.004 & 0 \\ 0 & 0 & 0.006 \end{vmatrix}; \quad X = \begin{vmatrix} 50 \\ 100 \\ 150 \end{vmatrix}; \quad d = \begin{vmatrix} 1 \\ 1.2 \\ 1.4 \end{vmatrix}; \quad Y = \begin{vmatrix} 50 \\ 120 \\ 210 \end{vmatrix}$$

Нагадаємо, що складові n_{ij} , a_{ij} матриці Π та A визначають кількість n_{ij} робочих місць та час a_{ij} обслуговування заявок по i -ому каналу на j -й фазі. Складові r_i та d_i векторів R та d визначають, відповідно, вартість робіт та оплату за обслуговування в умовних одиницях по i -ому каналу СМО. Складові x_i вектора X визначають інтенсивність надходження заявок на обслуговування по i -ому каналу, а складова y_i вектора Y - визначає передбачуваний дохід за обслуговування по i -ому каналу з врахуванням інтенсивностей x_i заявок, що надходять на обслуговування.

Варіант 2. Відрізняється від 1 тим, що час a_{ij} обслуговування заявок знижено в 4 рази:

загальному вигляді час обслуговування заявок i -ому каналу на j -й фазі.

Рівність $V = D - R_C$ між доходом D , який визначається за (5) та витратами R_C , які визначаються за (4), виражає прибуток СМО та може бути визначена з врахуванням (4) та (5) наступною розрахунковою формулою:

$$V = \sum_{i=1}^n y_i - Y^T A \cdot X - R_1^T \cdot \Pi \cdot R \quad (6)$$

Знижувати вартість робіт R_i можна лише за рахунок підвищення продуктивності шляхом технічного прогресу. Таким чином, технічний прогрес є основою підвищення прибутків та є основою бізнесу.

Розглянемо декілька прикладів досягнення прибутку V . При цьому, встановимо умову, відповідно до якої зниження часу обслуговування a_{ij} в e разів забезпечується збільшенням числа робочих місць n_{ij} в стільки ж e разів.

Варіант 1. Дано:

$$A = \begin{vmatrix} 0.005 & 0 & 0 \\ 0 & 0.001 & 0 \\ 0 & 0 & 0.0015 \end{vmatrix}$$

Варіант 3. Відрізняється від 1 тим, що час a_{ij} обслуговування заявок знижено в 2 рази, а інтенсивність x_i заявок на обслуговування збільшено в 2 рази, таким чином:

$$A = \begin{vmatrix} 0.001 & 0 & 0 \\ 0 & 0.002 & 0 \\ 0 & 0 & 0.003 \end{vmatrix}; \quad X = \begin{vmatrix} 100 \\ 200 \\ 300 \end{vmatrix}$$

Результати розрахунку за формулою (6) для всіх трьох варіантів та для десяти значень e часу обслуговування a_{ij} та числа робочих місць Π_{ij} наведені в таблиці 1.

Залежність доходу, витрати та прибутку від числа робочих місць

e	Варіант 1			Варіант 2			Варіант 3		
	D	R_c	V	D	R_c	V	D	R_c	V
1	138	33	105	320	33	286	276	33	243
2	259	66	193	350	66	284	518	66	453
3	299	99	200	360	99	261	599	99	500
4	320	132	188	365	132	233	639	132	507
5	332	165	167	368	165	203	663	165	498
6	340	198	142	370	198	172	679	198	481
7	345	231	114	371	231	140	691	231	460
8	350	264	86	372	264	108	700	264	436
9	353	297	56	373	297	76	706	297	409
10	356	330	26	374	330	44	712	330	382

Відповідно до даних, які наведені в таблиці 1 були побудовані графічні залежності (рис.1, 2, 3) загального доходу D системи, витрат R_c на обслуговування заявок на прибуток V системи від збільшення кількості e робочих місць.

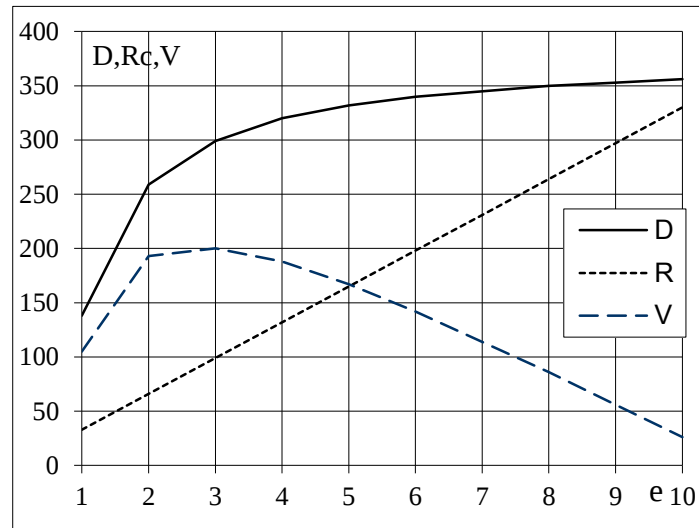


Рис.1. Залежність доходу, витрат та прибутку від числа робочих місць для варіанту 1

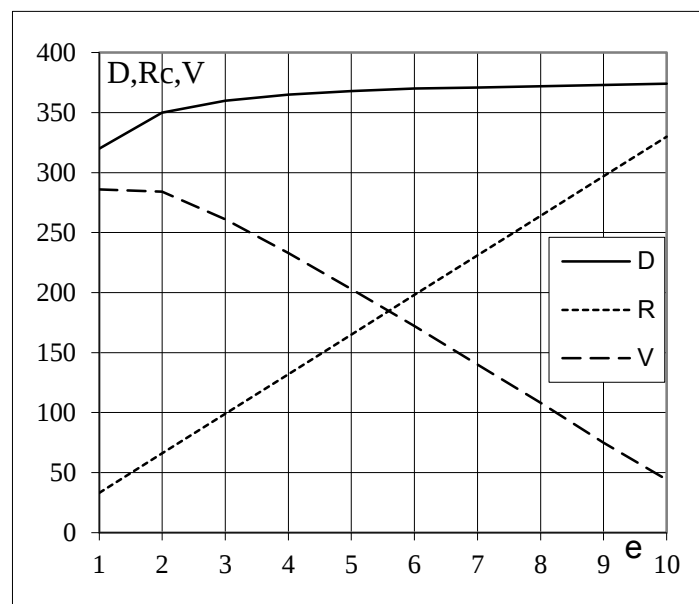


Рис.2. Залежність доходу, витрат та прибутку від числа робочих місць для варіанту 2

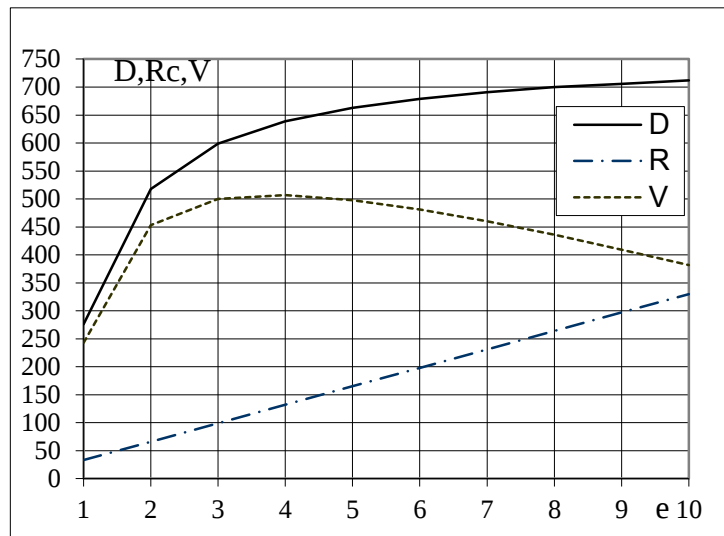


Рис.3. Залежність доходу, витрат та прибутку від числа робочих місць для варіанту 3

Аналіз отриманих даних та графіків (рис.1, 2, 3.) дозволяє зробити наступні висновки:

1. За даними варіанта 1 максимальний прибуток досягається, коли по всіх каналах і фазах кількість робочих місць e збільшено до 3. Подальше збільшення числа e робочих місць зумовлює малий приріст доходу зі збільшенням витрат, і внаслідок цього прибуток V знижується.

2. Слід зазначити цікаву особливість: при $e=1$ і $e=7$ забезпечується один й той самий прибуток V .

3. В варіанті 2 порівняно з варіантом 1 продуктивність робочих місць збільшена в 4 рази, і внаслідок цього відпала необхідність збільшення робочих місць. Максимальний прибуток зріс на 40% і досягається тоді, коли $e=1$.

4. Варіант 3 порівняно з варіантом 1 передбачає збільшення продуктивності праці в 2 рази, а інтенсивність заявок, що надходять, також збільшена в 2 рази. В результаті цього прибуток зріс у 2.5 рази при оптимальному збільшенні числа робочих місць до $e=4$. Прибуток залишається однаковим зі збільшенням числа робочих місць $e=2$ і $e=7$.

Таким чином, запропонована методика, в принципі, дозволяє обрати оптимальну структуру СМО, що забезпечує максимальний прибуток.

Змінюючи структуру СМО, за допомогою запропонованої методики можна вибрати такий варіант СМО з урахуванням конкретних технологічних умов організації, який забезпечив би максимальний прибуток з мінімальною кількістю витрат.

Число e змін робочих місць можна також вводити диференційовано для різних каналів та фаз, вибираючи такі значення e_{opt} , які забезпечили б максимальний загальний прибуток системи.

Вибір оптимальної структури СМО з диференціальним збільшенням e_{ij} числа робочих місць можна здійснити за допомогою алгоритму Гаусса-

Зейделя [5]. Алгоритм простий та ефективний. Суть алгоритмів зводиться до такого:

1. Як цільову функцію слід вибрати функцію прибутку V , що визначається виразом (6).

2. Необхідно задати векторами X інтенсивності надходження заявок, а також векторами d та R , відповідно оплату за обслуговування та вартості робіт.

3. Виконуючи покрокову зміну кратностей e_{ij} збільшення числа робочих місць n_{ij} і таке ж зменшення часу t_{ij} обслуговування в i -ому каналі на j -й фазі, можливо знайти таку оптимальну структуру СМО, що задається певними значеннями елементів a_{ij} та n_{ij} , відповідно, матриць A та

Π , яка забезпечила б глобальне максимальне значення V_{max} прибутку, що обумовлюється оптимальною структурою СМО при заданих вихідних умовах, що визначаються векторами X, d, R .

4. При незначній модифікації наведеного алгоритму можна отримати алгоритм введення суміщених та несуміщених фаз для забезпечення глобального максимуму V_{max} прибутку.

5. Якщо ввести функціональні зв'язки між векторами X, d, R , наприклад,

$$x_i = \frac{k}{d_i}; \quad R_i = \alpha \cdot d_i \text{ при } \alpha < 1, \text{ то за до-}$$

помогою наведеного алгоритму можна побудувати номограму, що дозволить графічно обрати оптимальну структуру СМО, що забезпечить максимальний прибуток, виходячи з конкретних вихідних умов, визначених векторами X, d, R та заданими функціональними зв'язками між ними.

Вибір раціонально організованої структури СМО можна звести до наступних загальних принципів:

1. Система повинна бути організована таким чином, щоб діагональні елементи a_{ij} матриць A перевищували суму або дорівнювали сумі недиагональних елементів a_{ij} рядка.

2. Величина діагональних елементів a_{ij} повинна перебувати у зворотному пропорційній залежності від величини інтенсивності x_i потоку заявок по i -ому каналу.

3. Зменшення величини елементів a_{ij} матриці A можна забезпечити введенням додаткових робочих місць n_{ij} на j -й фазі в i -ому каналі.

4. В ринкових умовах величину інтенсивності x_i потоку заявок можна регулювати величиною оплати d_i за обслуговування по i -ому каналу. Ці 2 величини в ринкових умовах знаходяться обернено пропорційній залежності.

5. Основним критерієм раціональної СМО є прибуток, що визначається різницею між загальним доходом і витратою для реалізації доходу.

6. Важливою умовою підвищення ефективності СМО є підвищення продуктивності праці на окремих ділянках, що досягається за рахунок технічного прогресу.

Висновки.

1. Запропоновані задачі оцінки пропускної спроможності багатозадачних систем, за своєю суттю, є нелінійними, за рахунок лінеаризації умов задачі пропонується пропускну здатність СМО, що визначається ймовірністю необслуговування задачі оцінювати лінійними залежностями з певною заздалегідь заданою допустимою похибкою методу.

2. Похибка методу зменшується разом із зменшенням ймовірності необслуговування заявки, тобто підвищення вимог на пропуску спроможність.

3. Отримані лінійні залежності визначення пропускної спроможності дозволили знайти зручний математичний апарат, за допомогою якого нескладно оптимізувати структури СМО, що забезпечують максимальну пропуску здатність за мінімальних економічних витрат.

4. Визначено умови допустимих економічних витрат, які необхідні для створення оптимальних структур.

5. Запропоновано простий алгоритм вибору оптимальної структури багатоканальної, багатозадачної практично застосовуваної структури СМО.

6. Запропонований алгоритм дозволяє скласти програму оцінок економічної ефективності практичної структури СМО у конкретних умовах її застосування.

7. Запропонована методика оцінок пропускної спроможності СМО дозволяє легко знайти оптимальну кількість робочих місць в організаціях та установах, які обслуговують споживачів, у точу числі в наукових бібліотеках ВНЗ, зокрема, у системах локальних комп'ютерних мереж, запропонованих на вирішення певного конкретного кола завдань.

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EARTH SCIENCES

MEASURES FOR THE OPERATION OF WELLS BY THE GAS LIFT METHOD AND PREPARATION, TRANSPORTATION OF NATURAL AND ASSOCIATED GAS AT GAS CONDENSATE FIELDS

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Abstract

Mandatory research and measurement complexes for monitoring development should cover evenly the entire area of the development object, the entire fund of observation wells. They should contain measurements of reservoir pressure for control and piezometric wells, measurements of reservoir and bottom-hole pressures, well flow rates for liquid, gas factors and water content of products for producing wells, measurements of wellhead injection pressures and injection volumes for injection wells, hydrodynamic studies of producing and injection wells in stationary and non-stationary modes, studies on the control of the oil and water contact, gas and oil contact, oil and gas saturation, technical condition of the wellbore by field-geophysical methods, selection and research of deep oil samples, surface rock products of wells (oil, gas, water).

The article considers in detail proposals to improve the system of collection, preparation and transport of natural, associated gas and condensate on the example of the Altyguyi gas condensate field. As well as the operation of gas wells, the condition and suggestions for improving the gas and condensate collection and treatment system. The resources of high-pressure gas, which ensures its preparation to the required conditions at the integrated gas treatment plant, corresponding to the calculated values of the inlet pressure.

The peculiarity of the operation of the gas processing unit (integrated gas treatment unit) at the current stage of field development and the need to maintain pressure at the inlet to the installation to ensure the required quality of export gas is considered.

Keywords: condensate degassing, aggregate, group metering unit, booster pumping unit, gas factor, perforation interval, associated gas, natural gas.

The operational and technical characteristics of productive oil wells of the Altyguyi field are given in Tables 1 and 2.

The flow rate of 24 fountain wells is 82-6 t/day, the water content is 1-30%, only the water content of 3 wells (№№ 7, 16, 18) is 73; 71; 77%. The gas factor is 205-1129 m³/t and the oil solidification temperature is 36-37 °C.

Table 1

Operational and technical characteristics of productive oil wells of the Altygyi field

№ wells	Method of operation	Horizon	Down-hole (m)	Interval Perforations (m)	Output (t/day)		Water cut Water cut, %	Gas factor m ³ /t
					Q _{fluid}	Q _{oil}		
21	fountain	NK-8	4007	4001-4004 3993-3998 3994-4000	17	16	6	401
3	fountain/ gas lift	NK -9	3757	3732-3778	19	17	13	309
4	fountain	NK -9	3770	3728-3740	40	39	3	289
7	fountain	NK -9	3758	3746-3750	26	7	73	461
10	fountain	NK -9	3674	3653-3662	24	22	8	513
11	fountain	NK -9	3868	3833-3839	53	37	30	349
12	fountain	NK -9	3740	3720-3726	60	58	3	501
16	fountain/ gas lift	NK -9	3875	3850-3857 3800-3806 3769-3775	7	2	71	1129
17	fountain	NK -9	3860	3842-3848	79	78	1	331
18	fountain	NK -9	3905	3890-3896	35	8	77	403
19	fountain	NK -9	3910	3891-3897	84	82	2	401
24	fountain	NK -9	3751	3691-2302	56	52	7	205
51	fountain/ gas lift	NK -9	3685	3652-3662	13	12	8	403
52	gas lift	NK -9	3685	3672-3679	16	15	6	290
102	fountain	NK -9	3727	3695-3704	37	36	3	332
104	fountain	NK -9	3760	3714-3723	17	16	4	612
105	fountain	NK -9	3860	3838-3844	56	55	2	250
106	fountain	NK -9	3810	3783-3792	43	33	23	283
107	fountain	NK -9	3885	3864-3869	40	39	3	318
108	fountain	NK -9	3829	3790-3796	35	33	6	303
110	fountain	NK -9	3820	3789-3791	12	11	8	513
111	fountain	NK -9	3880	3834-3842	71	70	1	283
112	fountain	NK -9	3771	3763-3769	55	53	4	374
113	fountain	NK -9	3705	3686-3695	7	6	8	726
114	fountain	NK -9	3700	3682-3691	44	36	18	403

Table 2

Operational and technical characteristics of productive oil wells of the Altyguyi field

№ wells	Method of operation	Horizon	Downhole (m)	Interval Perforations (m)	$P_b/P_{ann.}$	Fitting diameter (mm)	Gas inlet depth (m)	Note
21	fountain	NK -8	4007	4001-4004 3993-3998 3994-4000	34/118	5	2200	
3	fountain/ gas lift	NK -9	3757	3732-3778	60/105	4		
4	fountain	NK -9	3770	3728-3740	44/106	8		
7	fountain	NK -9	3758	3746-3750	24/153	5		
10	fountain	NK -9	3674	3653-3662	76/154	6		
11	fountain	NK -9	3868	3833-3839	27/136	6		
12	fountain	NK -9	3740	3720-3726	153/248	8		
16	fountain/ gas lift	NK -9	3875	3850-3857 3800-3806 3769-3775	152/155	5		Puncher 2000 m
17	fountain	NK -9	3860	3842-3848	57/143	8		
18	fountain	NK -9	3905	3890-3896	15/116	4		
19	fountain	NK -9	3910	3891-3897	114/122	8		
24	fountain	NK -9	3751	3691-2302	118/144	8		
51	fountain/ gas lift	NK -9	3685	3652-3662	31/94	5		Puncher 2000 m
52	gas lift	NK -9	3685	3672-3679	46/76	6	2200	Puncher 2000 m
102	fountain	NK -9	3727	3695-3704	100/114	6		
104	fountain	NK -9	3760	3714-3723	63/154	4		
105	fountain	NK -9	3860	3838-3844	81/152	8		
106	fountain	NK -9	3810	3783-3792	122/136	5		
107	fountain	NK -9	3885	3864-3869	78/110	5		
108	fountain	NK -9	3829	3790-3796	63/115	6		
110	fountain	NK -9	3820	3789-3791	52/137	4		
111	fountain	NK -9	3880	3834-3842	57/148	8		
112	fountain	NK -9	3771	3763-3769	13/167	4		
113	fountain	NK -9	3705	3686-3695	70/112	8		
114	fountain	NK -9	3700	3682-3691	102/136	6		

In 2011, 2 wells (№№. 3 and 51) were transferred to gas lift operation. In 2014, due to the transition of these two wells to a semi-spontaneous mode of operation, the supply of a working agent was stopped [1]. And now these wells are working in a fountain way. During the operation of wells by the gas lift method, over time, there was a decrease in annular pressure, oil degassing and an increase in dissolved gas in the composition of the extracted products. As a result, this condition led to the transition of wells from the gas lift to the fountain method of operation.

Table 3

The proposed variant of the development of the transition
of fountain wells to the gas lift method of operation for the Altyguyi field
(basic option I)

Indicators	Unit of measurement	2022	2023	2024	2025	2026	2027
Oil production	thousand tons						
Liquid extraction	thousand tons						
Associated gas resources	miln m ³						
Transfer of wells to the gas lift method	well		5	6	7		
Fund of gas lift wells operating until the end of the year	well	1	6	12	19	19	19
Average oil flow rate of operating wells	t/day						
by liquid	t/day						
Water cut	%						
Required gas resource for gas lift	miln m ³	1,9	5,9	30,2	32,3	43,1	41,7

(Option II)

Indicators	Unit of meas.	2022	2023	2024	2025	2026	2027
Oil production	thousand tons						
Liquid extraction	thousand tons						
Associated gas resources	miln m ³						
Transfer of wells to the gas lift method	well		7	12	12	12	12
Fund of gas lift wells operating until the end of the year	well	1	8	20	32	44	56
Average oil flow rate of operating wells	t/day						
by liquid	t/day						
Water cut	%						
Required gas resource for gas lift	miln m ³	1,9	19,7	68,8	141	188	209

(Option III)

Indicators	Unit of meas.	2022	2023	2024	2025	2026	2027
Oil production	thousand tons						
Liquid extraction	thousand tons						
Associated gas resources	miln m ³						
Transfer of wells to the gas lift method	well		11	24	13	7	6
Fund of gas lift wells operating until the end of the year	well	1	12	36	49	56	62
Average oil flow rate of operating wells	t/day						
by liquid	t/day						
Water cut	%						
Required gas resource for gas lift	miln m ³	1,9	11,0	45,4	88,7	120	120

Subsequently, with the time of reduction of reservoir pressure on productive formations, it will be necessary to restore the gas supply and switch to the gas lift method of operation.

Currently, 52 wells are being operated at the field. According to the calculations of the field development, the transition of all fountain wells to operation by the gas lift method is being considered.

Table 3 shows the proposed options for the development of the transition of fountain wells to the gas lift method of operation.

In the gas lift mode, the supply of the working agent in the range of 2000-2200 meters lifts are carried out at 38 °C with heated gas through the holes of the gas lift valves temporarily installed in place [2, 3].

At the field, gas is supplied to gas lift wells with operating pressures of 70-85 kgf/cm² by special gas compression lines. The gas consumption for each well currently averages 15 thousand m³/day.

To operate the lift with the greatest efficiency, i.e. with the minimum specific consumption, it is necessary that the lift operates at the optimal flow rate, which requires the greatest immersion under the dynamic level,

i.e. the length of the lift must be equal to the depth of the well. The minimum specific flow rate in the maximum feed mode is provided if the relative immersion is $\xi = 0.5$, and for the optimal mode the relative maximum flow rate is $\xi = 0.6$ [4].

Operated gas lift wells need to be optimized according to existing methods. According to calculations, in gas lift wells with a gas inlet point of 2300 - 2500, we accept a working pressure of $P_{\text{work}} = 6.4; 7.4; 8.4$ MPa, and in wells with a gas inlet depth of 3000 - 3500 m - 10-12 MPa. At gas condensate fields, it is necessary to implement a closed-cycle compressor gas lift with high-quality gas preparation for the needs of the gas lift and with further gas supply to the export gas pipeline.

The system of collection and preparation of products at the wells of the Altyguyi field is compatible with the collection and preparation of products at the wells of the Korpedje field.

The system of collecting and preparing gas condensate wells of the Altyguyi field is shown in the figure.

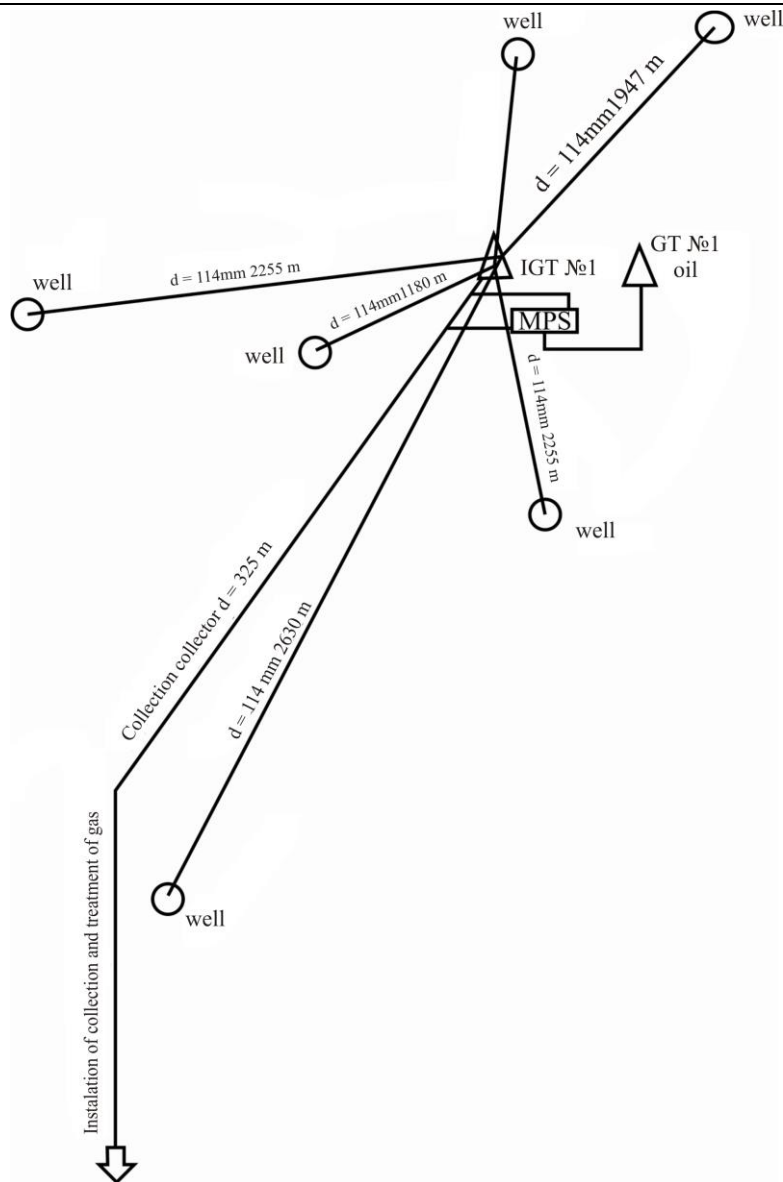


Figure. The system of collecting and preparing gas condensate wells of the Altyguyi field

The products of gas condensate wells with gas pipelines are sent to a complex metering unit and from there they are sent through collectors to the first stage of the Korpedje complex gas treatment plant.

Let's consider the features of the energy technology complex of a gas condensate field on the example of the Western part of Turkmenistan, including producing wells, a collection system, a preparation system and compression of the extracted gas in the aspect of expediency (necessity) of modification (reconstruction) for the future covered by the field development project [5].

The compressor station (CS) provides:

1. compression of associated gas coming to the CS reception through the gas pipeline in three compression stages: from 0.3 MPa to 7.5 MPa;
2. compression of associated gas coming to the CS reception via combined gas pipelines from oil and gas collection points (DNC-1 and DNC-2) by fields;
3. compression of the natural gas of the gas condensate field itself, which is received by the CS through an incoming combined gas pipeline connected to the corresponding group measuring units (GMU).

The technical and technological features of the CS are also:

- the presence at the compressor station of two units (with cooling systems) of the first and second stages of compression of associated gas from an inlet pressure of 0.3 MPa to a pressure of 2.8 MPa, which is the inlet pressure to the terminal (third) compression stage;
- the presence at the compressor station of three units at the third compression stage, one of which is designed to compress associated gas, and the other two to compress natural gas coming directly to the final compression stage from the natural gas supply pipeline;
- the presence of a gas cooling system by low-temperature mechanical refrigeration, i.e. by low-temperature condensation, which is provided by generating cold on steam compression machines using a refrigerant - freon.

The gas resources that can be disposed of (sent to the consumer with the required gas quality) through the CS are unambiguously equal to its design productivity per year while maintaining the above pressure at the inlet to the CS through two gas streams [6,7].

A feature of the operation of the gas processing unit (integrated gas treatment unit) at the current stage of field development is the need to maintain a pressure at the inlet to the installation that ensures the required quality of export gas, i.e. obtaining dew points for water and hydrocarbons established by the gas supply contract.

The current analysis of the parameters of the operation of the IGTU reveals a shortage of reservoir energy of the gas pressure entering the IGTU in the modes corresponding to the design performance.

We note that the overall (integral) effect of gas cooling using low-temperature gas separation technology using regenerative heat exchange largely depends on the type of installed heat exchanger, i.e. its design features and the area of the heat exchange surface [8].

The heat exchangers installed on the IGTU provide an almost twofold decrease in the temperature of the gas entering the low-temperature separator in relation to the Joule-Thompson choke effect.

The formula for determining the required operational value of the gas separation temperature (in a low-temperature separator) is presented as:

$$T_{\text{sep}} = T_{\text{ent.}} - \Delta T_{\text{thr.}} - \Delta T_{\text{TO}}$$

$T_{\text{ent.}}$ is the temperature of the gas at the entrance to the IGTU;

$\Delta T_{\text{thr.}}$ - reducing the temperature on the throttle due to the Joule Thompson effect:

$$\Delta T_{\text{thr.}} = \frac{\Delta P}{\varepsilon}$$

$\Delta P_{\text{thr.}}$ is the pressure drop on the throttle, MPa;

ε is the Joule-Thompson coefficient, determined by the thermodynamic conditions of throttling and assumed to be $\varepsilon = 0.27 \text{ MPa/}^\circ\text{C}$;

ΔT_{O} is a decrease in the temperature of the gas in the heat exchanger, which, according to operational data, is represented as:

$$\Delta T_{\text{thr.}} = 2\Delta T_{\text{thr.}}$$

The critical value of the pressure at the inlet to the IGTU, at which the conditions for the preparation of conditioned gas are met, is determined by the ratio:

$$P_{\text{ent.cr.}} = P_{\text{req.}} + P_{\text{thr.}}$$

where $P_{\text{req.}}$ is the pressure at the beginning of the gas pipeline (at the outlet of the IGTU), which, in turn, is determined depending on the values of the required pressure at the end of the pipeline and pressure losses in the pipeline;

$$P_{\text{req.}} = P_{\text{ter.}} + \Delta P_{\text{g.p.}},$$

where: $P_{\text{ter.}}$ is the terminal pressure accepted under the terms of gas supply equal to 5.6 MPa.

As a result of calculations based on the above ratios, the necessary pressure drop at the IGTU to obtain conditioned gas with a dew point on water $T_{\text{d.w.}} = 0^\circ\text{C}$ is in summer $\Delta P \sim 3.0 \text{ MPa}$ and in winter $\Delta P \sim 1.5 - 2.0$, which corresponds to the need to provide at the entrance to the IGTU pressure $P_{\text{ent.}} \sim 9.5 \text{ MPa}$ in summer and 8.5 MPa in winter.

The resources of high-pressure gas, which ensures its preparation to the required conditions at the IGTU, corresponding to the above calculated values of the inlet pressure, are determined in this field development project for the future under consideration [9].

Due to the projected reduction in high-pressure gas resources in the future, in order to maintain the operation of the gas compressor station in modes that ensure gas preparation to export condition, an urgent construction of a booster compressor station is required.

At the Altyguyi field, when choosing the gushing mode (the diameter of the fitting), it is necessary that the well has an optimal flow rate with a small gas factor, gives less water and sand, gushes calmly, without large pulsations. Only when these conditions are met, it is possible to ensure the most rational use of reservoir energy and long-term, uninterrupted gushing of the well.

When choosing the mode of operation of a fountain well, reservoir conditions are also taken into account - the proximity of contour water, the possibility of a plug in the well, the mode of the field itself, etc.

The main reasons for the disruption of the normal operation of fountain wells are the waxing of fountain pipes, the formation of a sand plug, corroding of the fitting, clogging of the fitting or ejection of paraffin complications, etc. [10].

Measures to restore the operation mode of wells are carried out depending on the reason that caused its violation.

When a sand plug is formed in the fountain pipes, which caused the buffer pressure to drop to zero and the supply is stopped, a liquid (oil) pump is flushed into the annular space to restore circulation and eliminate the plug.

A significant decrease in pressure in the annular space indicates the formation of a plug at the bottom and the appearance of water, the latter is detected by taking a sample from the jet. When water appears, it is necessary to increase the pressure on the face by reducing the diameter of the fitting. To eliminate the down-hole plug, the well is allowed to work without a fitting or oil is pumped into the annular space.

The pressure drop on the buffer while increasing the flow rate of the well indicates that the nozzle is corroded by sand, in this case it is necessary to transfer the fountain jet to another outlet and immediately change the nozzle.

If the specified method fails to eliminate sand jams in the lifting pipes or at the bottom, then the well is stopped for repair work, after which it is put into normal operation.

Dewaxing of the elevator is the main way to ensure the normal operation of fountain wells. The largest amount of paraffin is deposited in the upper part of the lifting pipes, at a length of 400 - 1000 m from the well-head and in the field oil collection system, in which paraffin deposition increases during the cold season. Several methods are used against waxing of lifting pipes. First of all, these are regime measures: reduction of pulsation and frequency of gushing, regulation of the gas factor in order to reduce it as much as possible.

If these measures do not give results, it is necessary to clean the lifting pipes from paraffin.

There are 3 types of cleaning from paraffin: mechanical, thermal, chemical [11, 12].

Mechanical cleaning of pipes from paraffin is carried out during the operation of wells without stopping them with scrapers of various designs.

When exposed to heat, the lifting pipes are heated with steam, hot oil pumped into the annulus of the well without stopping it. The melted paraffin is carried out by a jet of oil to the surface, while the paraffin melts in the switch line. The thermal method does not prevent the deposition of paraffin in pipes, it is used sporadically, under favorable conditions and when for some reason it is not possible to use other more effective methods.

As a solvent of paraffin, it is envisaged to use condensate (gasoline), which is extracted at the Altyguyi deposit in sufficient quantities.

The most characteristic complications in gas lift mining are the appearance of sand and cork formation, the deposition of paraffin in lifting pipes and discharge lines.

Measures against sand entering the well are of a regime nature and are reduced to limiting depression, i.e. limiting oil extraction. The amount of liquid extraction from gas lift wells is regulated by changing the amount of injected working agent, the depth of immersion of lifting pipes or their diameter. To prevent the settling of sand during the periods of its greatest inflow from the reservoir, without interrupting operation, oil is pumped into the annulus in small portions by a mobile pump.

Sometimes the pressure of the gas injected into the well increases sharply when the liquid supply is stopped at the same time. This may occur due to the formation of a so-called cartridge sand plug in the lifting pipes, which blocks the section of the lifting pipes, preventing the mixture of oil and injected gas from reaching the surface. To destroy such a plug, gas is pumped not into the annular space, but into lifting pipes. If in this way it is not possible to push the plug from the pipes to the bottom of the well, then it is necessary to remove the pipes [13].

When wells are equipped with a single-row lift, it is finished with a shank of a smaller diameter than the main tubing string. The descent of the lifting pipes with a shank to the filter facilitates the conditions for the removal of sand by the liquid to the surface and prevents the formation of sand jams.

Measures to prevent paraffin deposits in lifting pipes during gas lift operation of wells, and methods for cleaning pipes from paraffin are similar to those used in fountain operation.

With the drop in reservoir pressures and the flooding of reservoirs at some stages of development in the gas condensate fields of the western part of Turkmenistan, it is planned to improve the gas lift. It is proposed to install a column of lifting pipes equipped with borehole chambers with gas lift valves (starting and working) located in them in the production column on the packer. This eliminates the influence of the injected gas

on the flow of liquid into the well. It is planned to conduct research on optimizing the operating modes of gas lift wells according to known methods to determine the optimal flow rate.

It is also necessary to equip the gas lift gas distribution system with regulating and measuring equipment.

All the measures mentioned above are aimed at increasing and stabilizing gas lift production and reducing the volume of injected gas.

At the Altyguyi gas condensate field under development, the number of gas lift wells will increase with the expiration of the operating time, since with the cessation of well gushing, it becomes necessary to transfer them to a mechanized method [14].

Under the existing modes of gas lift lifts, the depth of the input of the working agent (gas) is in the range of 1400 - 3000 m, the gas input into the lift is carried out through holes (punchers) temporarily replacing the working valves.

Gas supply to gas lift wells is carried out from the gas pipeline via separate gas injection lines at operating pressures of 6.2 - 11 MPa.

Operated gas lift wells need to be optimized according to existing methods. According to calculations, in gas lift wells with a gas inlet point of 2300 - 2500, we accept a working pressure of $P_{\text{work}} = 6.4; 7.4; 8.4$ MPa, and in wells with a gas inlet depth of 3000 - 3500 m - 10-12 MPa. At the Altyguyi gas condensate field, it is necessary to implement a closed-cycle compressor gas lift with high-quality gas preparation for the needs of the gas lift and further gas supply to the export gas pipeline.

The issues of ecology and nature protection include restrictions on the external impact on the environment, preventing the loss of hydrocarbon resources during the extraction, carrying out technical and control measures.

Oil and gas enterprises occupy one of the first places among other sectors of the national economy in terms of the degree of environmental impact. Exploration and development of oil fields includes such technologies as exploration drilling, oil production, collection and preparation of hydrocarbons, transportation and processing.

The enterprises of the oil and gas industry have a harmful effect on all objects of nature, the atmosphere, the hydrosphere and underground and surface waters, the geological environment, drilled wells at all depths, on the land where they are located.

The cycle of oil and gas works consists of two main groups:

1. New construction sites (search and exploration, drilling, installation of equipment)
2. Working processes of the enterprise (collection, processing, shipment and processing of oil and gas)

When carrying out construction work, a report is made on technogenic pollution of the earth and the environment for technical reasons.

A report on the measures taken to protect the environment should be prepared by oil and gas producing organizations [15].

It should be noted that the time spent on exploration, drilling and preparation of oil and gas fields, the production time of the enterprise, pollution is caused for technical reasons.

The performance of these works causes high harm to the environment. Ecological catastrophes that occur are physical and mechanical impacts on soil, land, flora, fauna, soil, lowering of hydrogeological conditions, strengthening of soil erosion conditions, deterioration of living conditions of fauna and flora and local residents, and others.

Currently, geological studies have been completed at the Altygyi gas condensate field and a field test plan has been prepared based on the data obtained.

When drilling wells in the fields, the environment is polluted mainly by some chemical elements used in the preparation of drilling fluids.

Currently, normal limit values, chemical elements indicating aggressiveness used in the preparation of drilling fluids have not been established.

During drilling operations, the source of atmospheric air pollution is diesel-fueled equipment that emits 2 tons of hydrocarbons and soot, 30 tons of nitrogen oxides, 8 tons of carbon monoxide and 5 tons of sulfur anhydride into the atmosphere during the year. When drilling wells, drilling mud is mixed with soil layers, surface and groundwater, forming 30 m³/day of water used [16].

During the development of wells, hydrocarbon mainly causes pollution. In most cases, oil-based circulating solutions with serious environmental consequences produce used wastewater, suspension and colloidal solution.

When preparing environmental protection measures during installation work in wells, it is necessary to avoid work that negatively affects natural objects. Since the sources of pollution are closely related to the technology used by the enterprise, it is necessary to establish the technology that has the least impact on the environment. When geochemical breakdown of the soil, it is necessary to perform the following:

- When preparing plots, it is necessary to prevent contamination of the topsoil from the products obtained;
- To collect sedimentary rocks of drilled rocks on slurry barns;
- It is necessary to cover the slurry barn;
- Restore the soil area of the extracted products;
- Road construction.

As a result of drilling operations, there is a negative impact on the hydrogeological change in the soils of the earth, and as a result, drilling fluids penetrate into aquifers, which lead to the formation of a complex of waters.

The waters used in drilling fluids are divided into three groups:

1. Water formed during the production of works;
2. Water for household work;
3. Atmospheric, rainwater.

Circulating waters are used to carry drilled rocks to the surface. In world practice, 95% of clay elements are mixed into the composition of circulating waters for the preparation of drilling fluids.

The quality of the flushing solutions used helps the speed of drilling operations, the prevention of complications with colmatation and water occurrence [17].

During the operation of producing wells and oil and gas collection facilities, the integrated safety and environmental protection system includes:

- monitoring of the condition of borehole fittings;
- selection of equipment and pipelines that meet the specified operating conditions, taking into account current regulations;
- periodic testing of equipment for strength (crimping);
- corrosion protection;
- prevention of technological complications that create emergency situations (gas communications flooding, deposition of paraffin and salts in wells and collection systems), with the use of special inhibitor substances.

When collecting and storing oil, the requirement of safety and reduction of hydrocarbon emissions into the environment are ensured at the stage of arming assembly points in compliance with building codes and regulations, with the necessary equipment of tanks with floating roofs or breathing valves, with mandatory collapse of tank farms to localize emergency oil spills [18].

When implementing the gas lift method of oil production, with a high manifestation of gas injected into the well to ensure safety and environmental protection, it is envisaged (in addition to the design and construction of the main facilities in full compliance with the required technological parameters of operation according to the current building codes and regulations) the construction and proper operation of additional technological equipment that provides a hydrate-free operation of gas distribution systems (furnaces for heating gas and inhibition unit). In the case of the construction of furnaces for heating hydrocarbons, make a preliminary calculation of atmospheric pollution by combustion products and assess the need to determine the MPC.

Storage and use of chemicals is planned to be carried out in accordance with their individual characteristics and in accordance with Safety Regulations (SR) in the oil industry, including providing employees with personal protective equipment (PPE), carrying out instructions and monitoring the condition of equipment used for the use of chemicals (surfactants, methanol, etc.).

The operation of electrical installations and heating equipment is provided in accordance with the current rules of SR and fire safety rules.

According to estimates, in oil fields with a similar technology of oil extraction and collection, the maximum concentrations of the above harmful substances at the border of the sanitary zone (within a radius of 1000 m from the source of emission) do not exceed the maximum permissible (MPC), which are set for each harmful substance individually according to the methodology of the State Committee for Hydrometeorology (OND-86).

In this regard, emissions of harmful substances into the atmosphere, subject to regular (accident-free) technological modes of operation of oil and gas field

equipment, can be considered approximately corresponding to the maximum permissible emissions (MPI) [19].

A detailed assessment of emissions for all fishing facilities is taken into account when compiling an environmental passport.

The environmental passport is being developed in accordance with GOST 17.0.0.04-90 "System of standards in the field of nature protection and improvement of the use of natural resources", which already gives the full technological cycle of this production from the supply of raw products to the finished product. At the same time, the presence of emissions, discharges and solid waste is carefully checked and calculated at each production facility and their impact on the environment is analyzed. All this material is described and calculated in the relevant chapters of the environmental passport. It also concludes that it is necessary to calculate the norms of MPD, the results of which are issued in the form of a second volume, but in the future, in the event of an increase in oil production due to Miocene-Paleogene and Mesozoic underlying red-colored sediments, it will be necessary to adjust all calculations on emissions.

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ELECTRICAL ENGINEERING

METHODS OF FORECASTING THE PRODUCTION OF SOLAR MODULES AND BATTERIES BASED ON METEOROLOGICAL DATA

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Abstract

The development of electronic systems based on renewable energy sources (RES) has made it possible to distinguish this class of energy sources into a separate energy sector. According to the forecasts of the European Photovoltaic Industry Association (EPIA), solar energy will displace oil and nuclear energy in the future. In the world, the annual growth of solar energy over the past five years has averaged about 50%. The energy obtained on the basis of solar radiation will hypothetically be able to provide 20-25% of humanity's electricity needs by 2050 and reduce carbon dioxide emissions.

Solar cells are considered the main choice for long-term power generation for satellites and space systems. This is mainly due to their high power-to-weight ratio and good scalability of solar modules in accordance with the power requirements of the space mission. The constant and significant increase in the efficiency of the devices has enabled the operation of advanced space systems, such as the International Space Station, rovers and satellites [1].

Keywords: renewable energy, solar cells, short and medium-term forecasting, machine learning.

Data analysis

The Python programming language was used to analyze meteorological data, and the pandas, seaborn, matplotlib and numpy libraries were used as packages. Datasets located on the "Open Power System Data" platform were used as data. The search for correlations in the data based on pairwise relations for meteorological weather indicators, as well as finding correlations using the Pearson correlation coefficient, was carried out.

Table 1 shows the correlation coefficients for each weather metric using the Pearson correlation coefficient. The main information parameters used for data analysis are: $v1$ – wind speed; $SWTDN$ – the value of the intensity of solar radiation to the atmosphere, W/m^2 ; $SWGDN$ – the value of the intensity of solar radiation on a horizontal platform near the ground, W/m^2 ; T – temperature, K ; ρ – the density of air at the surface, kg/m^3 ; p – air pressure, Pa .

Table 1

Correlation matrix

	<i>Solar Intensity</i>	<i>SWGDN</i>	<i>SWTDN</i>	<i>T</i>	<i>rho</i>	<i>p</i>	<i>v1</i>
<i>Solar Intensity</i>	1	0,95	0,86	0,79	-0,73	0,06	-0,39
<i>SWGDN</i>	0,95	1	0,93	0,79	-0,74	0,04	-0,38
<i>SWTDN</i>	0,86	0,93	1	0,79	-0,78	-0,1	-0,33
<i>T</i>	0,79	0,79	0,79	1	-0,95	0,017	-0,31
<i>rho</i>	-0,73	-0,74	-0,78	-0,95	1	0,28	0,22
<i>p</i>	0,06	0,04	-0,1	0,017	0,28	1	-0,25
<i>v1</i>	-0,39	-0,38	-0,33	-0,31	0,22	-0,25	1

The Python programming language was used to predict the generation of solar models. Pandas and numpy libraries were used as packages for working with data, seaborn and matplotlib were used for visualization, and sklearn was used as a library for machine learning.

The analyzed dataset should be divided into training and test samples. The separation will be carried out by sequentially cutting 80% of the sample to the training set (January-October 2017), and the remaining 20%

to the training set (October–December 2017). As the correct answers (y) for the model, the data of the $DE_solar_generation_actual$ column will be used, and the signs (X) for training will be: $SWGDN$, $SWTDN$, T , ρ , p , $v1$, $v2$, v_50m , $z0$.

There are various training parameters in the models, automatic selection of model parameters – GridSearch (lattice search algorithm) will be used to minimize the error.

Forecasting output

Least Squares Regression Line is a simple and widely used method for estimating the relationship between a dependent variable or response variable, such as solar radiation intensity, and a set of independent variables or predictors. Regression minimizes the sum of the squares of the differences between the observed

intensity of the Sun and the intensity of the Sun predicted by a linear approximation of forecast weather indicators.

Thus, the target function is *SolarIntensity*, and *Pressure*, *Temperature*, *WindSpeed*, *SkyCover*, *SWGDN*, *SWTDN*, *Z* are the parameters of the function $F(1)$:

$$\text{SolarIntensity} = F(\text{SWGDN}, \text{SWTDN}, \text{Temperature}, \text{SkyCover}, \text{Pressure}, \text{WindSpeed1}, \text{WindSpeed2}, \text{WindSpeed_50m}, z_0). \quad (1)$$

First of all we need to apply *Least Squares Regression Line* method to eight-month training data [2]. After training, the *LinearRegression* model with coefficients for each weather metric is presented in the formula (5.2):

$$\begin{aligned} \text{SolarIntensity} = & 688 + 17,70 \cdot \text{SWGDN} + 4,12 \cdot \text{SWTDN} - \\ & -264,57 \cdot T - 590,58 \cdot \text{rho} + 78,44 \cdot p - 11,02 \cdot v_1 + \\ & +123,81 \cdot v_2 - 30,432 \cdot v_{50m} + 105,81 \cdot z_0. \end{aligned} \quad (2)$$

Using the obtained multiple regression equation (2), we can construct a forecast graph of the predicted target variable and real (test) data (Figure 1).

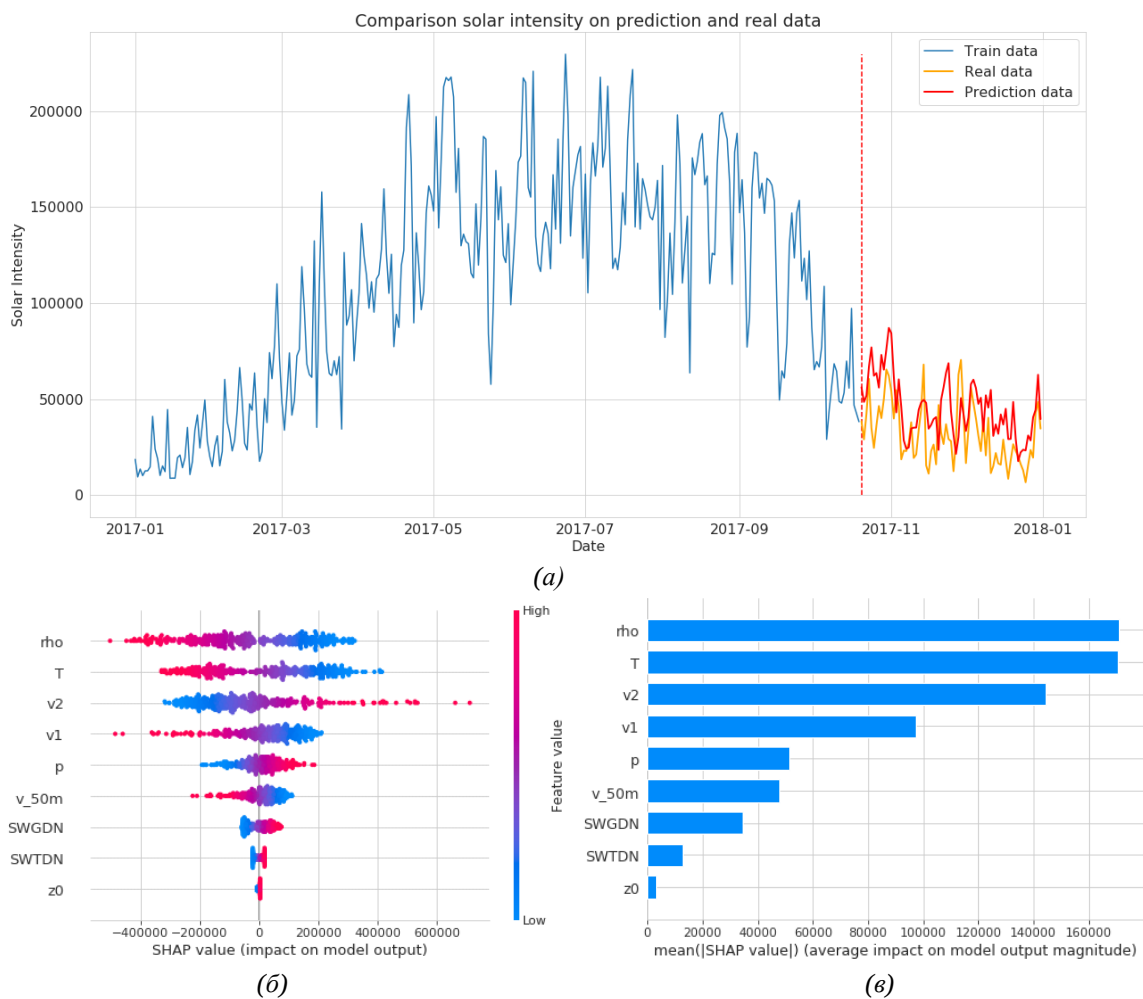


Figure 1 – Results of forecasting the generation of FES (a) and the influence of atmospheric parameters (b, c) Linear Regression

We can apply the penalizing linear *Ridge* model on the training data. After training, the *Ridge* model with coefficients for each weather metric is presented in formula (3):

$$\begin{aligned} \text{SolarIntensity} = & -700,18 + 17,88 \cdot \text{SWGDN} + 3,43 \cdot \text{SWTDN} - \\ & -593,46 \cdot T - 200,83 \cdot \text{rho} + 5,52 \cdot p - 96,67 \cdot v_1 + \\ & +39,06 \cdot v_2 - 7,405 \cdot v_{50m} + 46,18 \cdot z_0 \end{aligned} \quad (3)$$

Using the obtained multiple regression equation (3), we will plot the forecast of the predicted target variable and real (test) data (Figure 2).

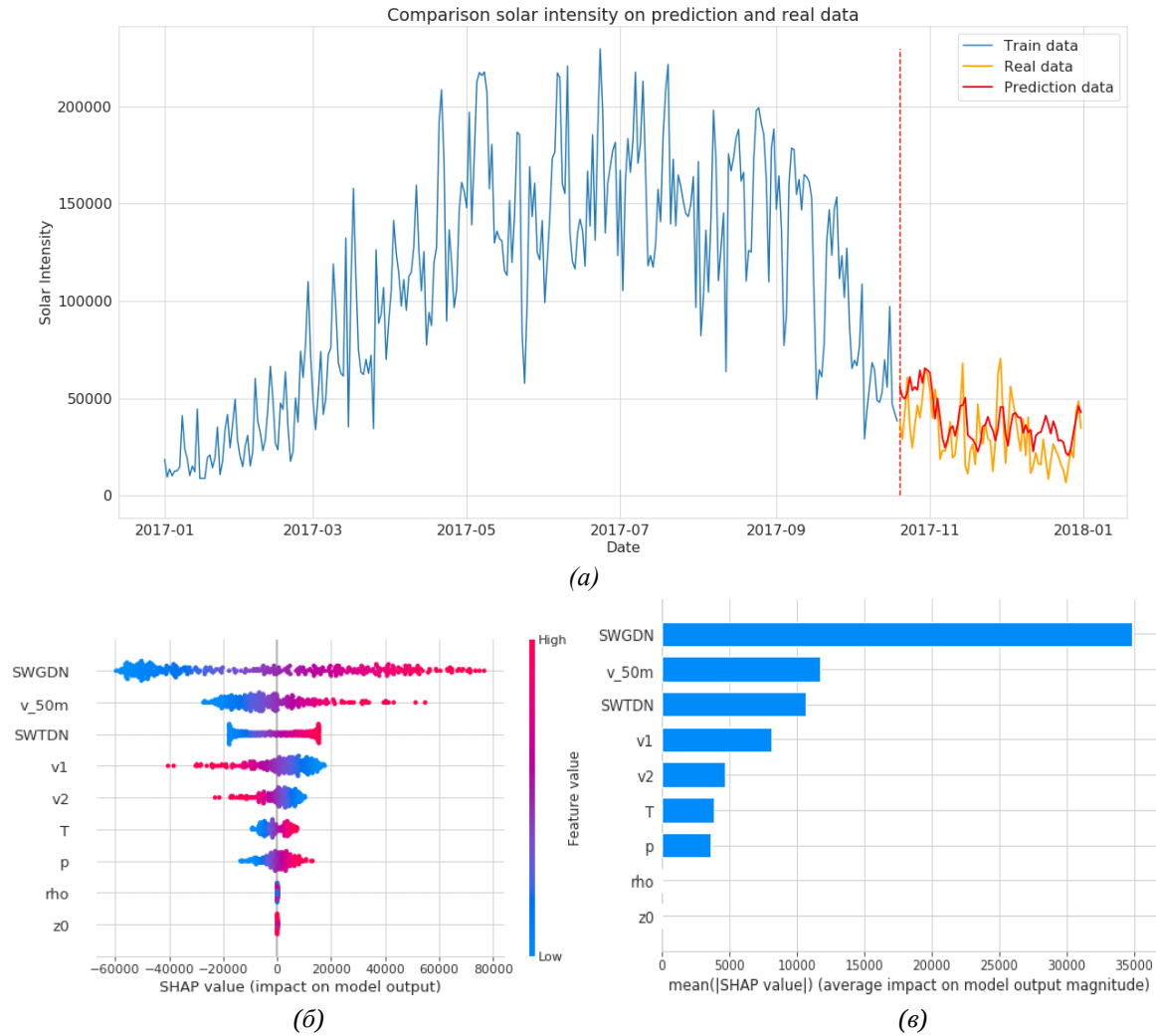


Figure 2 – Results of forecasting the generation of FES (a) and the influence of atmospheric parameters (b, c) Ridge

We can apply the Lasso penalizing linear model on the training data. After training, the Lasso model with coefficients for each weather metric is presented in formula (4):

$$\begin{aligned} SolarIntensity = & 269,91 + 17,51 \cdot SWGDN + 3,90 \cdot SWTDN - \\ & -11,5 \cdot T - 261,35 \cdot rho + 37,79 \cdot p - 68,93 \cdot v1 + \\ & +55,86 \cdot v2 - 51,24 \cdot v_{50m} + 74,89 \cdot z0 \end{aligned} \quad (4)$$

Using the obtained multiple regression equation (4), we will plot the forecast of the predicted target variable and real (test) data (Figure 3).

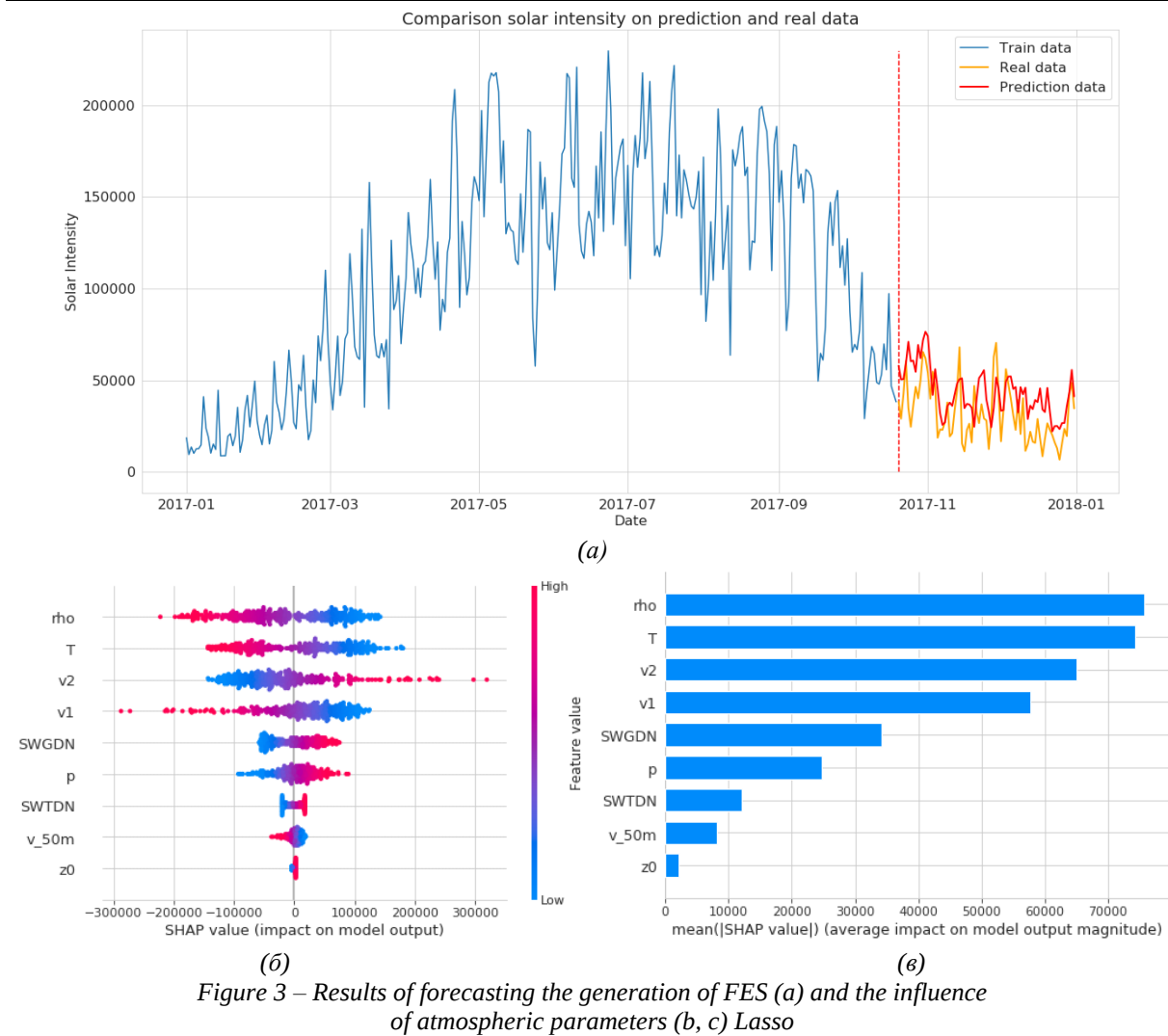
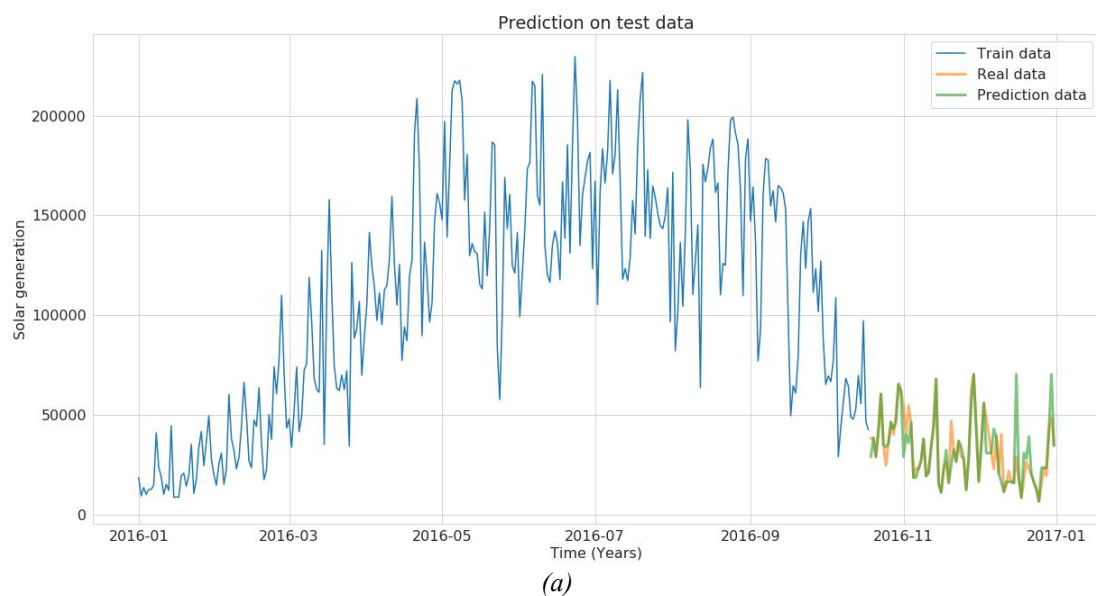


Figure 3 – Results of forecasting the generation of FES (a) and the influence of atmospheric parameters (b, c) Lasso

Note that linear regression without penalty and Lasso regression behave similarly, and this is observed in Figures 5.1 (c) and 5.3 (c). It is obvious that the importance of the features is approximately the same, and the difference from Ridge regression.

Figure 4 shows the results of forecasting output using the *DecisionTreeRegressor*.



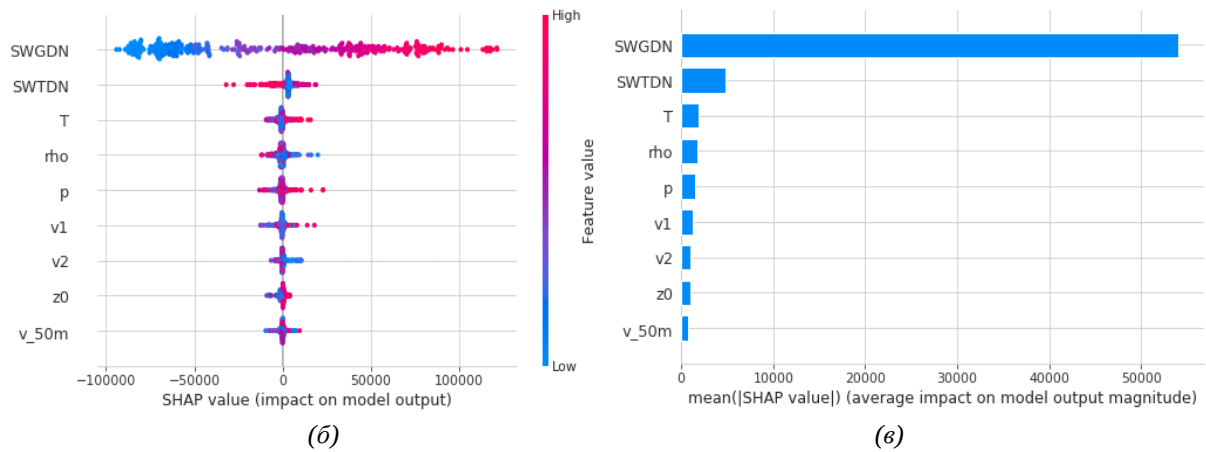


Figure 4 – Results of forecasting the generation of FES (a) and the influence of atmospheric parameters (b, c) *DecisionTreeRegressor*

Figure 5 shows the results of forecasting output using *RandomForestRegressor*.

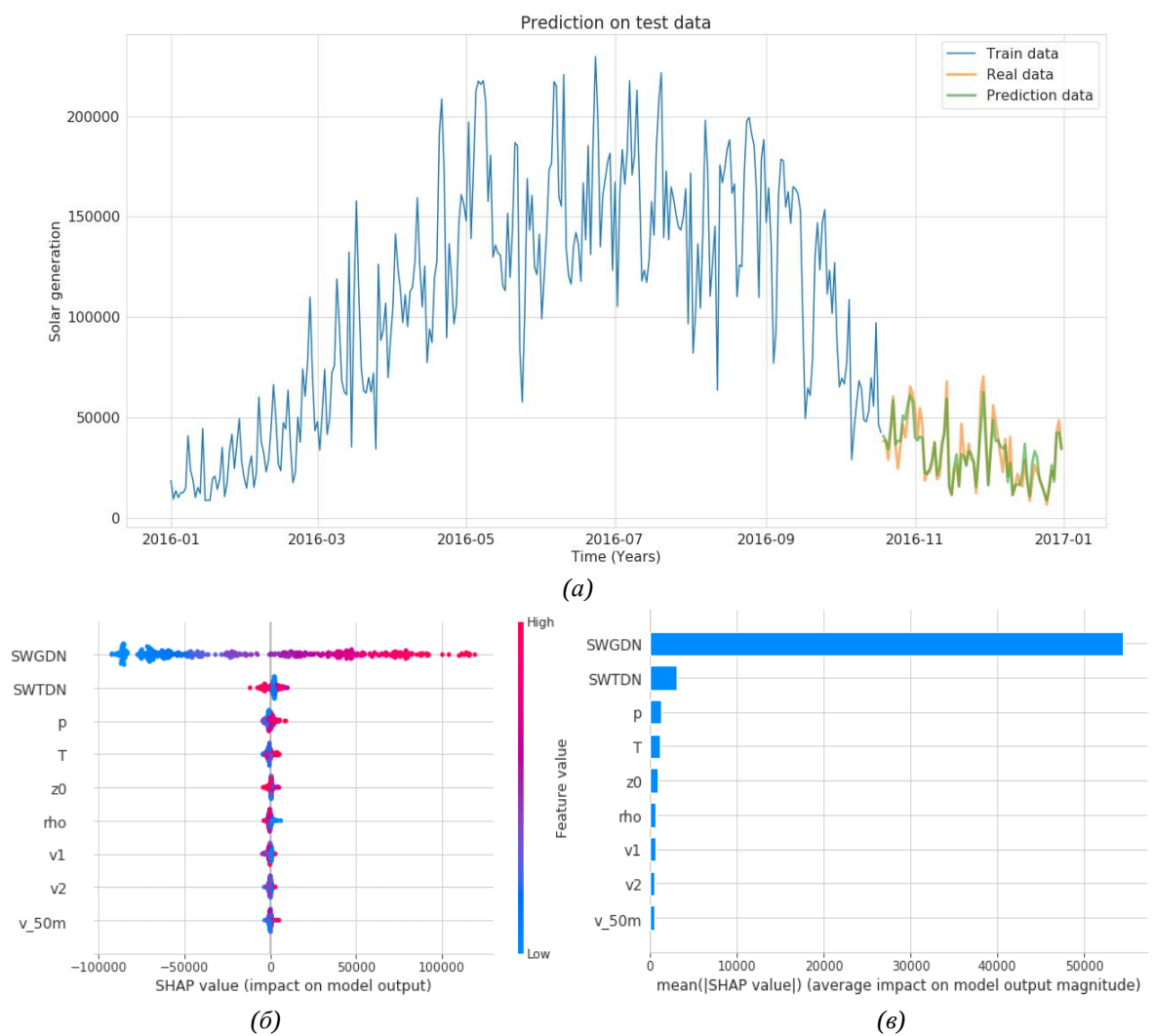


Figure 5 – Results of forecasting the generation of FES (a) and the influence of atmospheric parameters (b, c) *RandomForestRegressor*

Figure 6 shows the results of forecasting output using *Gradient Boosting Regressor*.

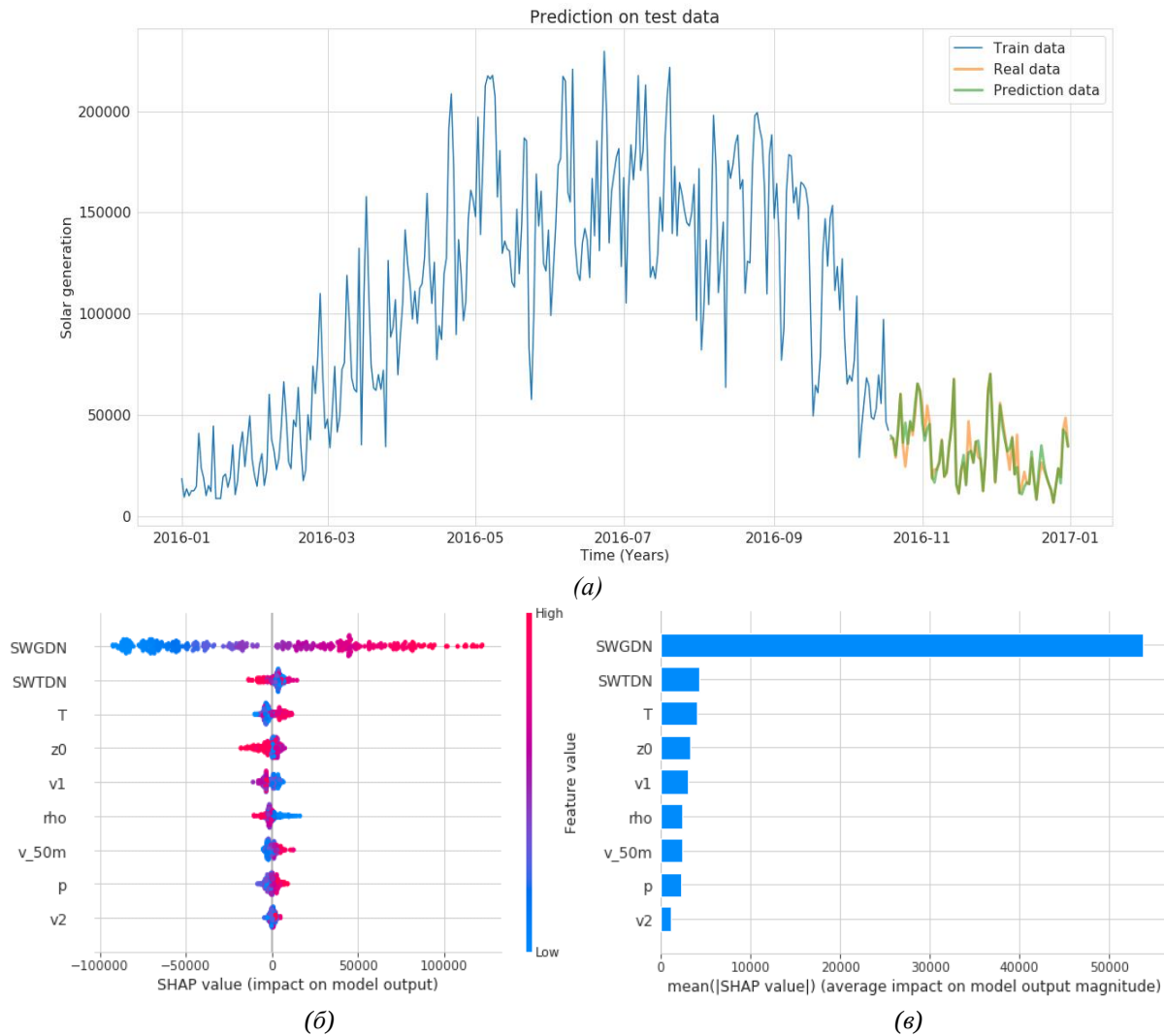


Figure 6 – Results of forecasting the generation of FES (a) and the influence of atmospheric parameters (b, c) GradientBoostingRegressor

As can be seen from all the graphs, the determining factor is the level of insolation at the surface, however, this parameter is variable and in itself depends on the level of clouds and humidity.

Model quality assessment

We can evaluate the quality of the obtained models using the criteria: mean quadratic error (MSE), R^2 statistics and average absolute error.

Table 2 shows quality metrics for linear models, and table 3 shows quality metrics for wood models.

Table 2

Quality metrics for linear models				
No in order	Forecasting method	Mean squared error (MSE)	Mean absolute error (MAE)	R^2
1	<i>LinearRegression</i>	387,92	16710,52	0,765 (mean) $\pm$ 0,1084 (std)
2	Ridge	209,98	11883,01	0,757 (mean) $\pm$ 0,1343 (std)
3	<i>Lasso</i>	301,35	14677,08	0,772 (mean) $\pm$ 0,0831 (std)

Table 3

Quality metrics for wood models

№ in order	Forecasting method	Mean squared error	Mean absolute error	R^2
1	<i>DecisionTreeRegressor</i>	79,53	4001,56	0,869 (mean) $\pm$ 0,0657 (std)
2	<i>RandomForestRegressor</i>	34,43	4204,331	0,935 (mean) $\pm$ 0,0287 (std)
3	<i>GradientBoostingRegressor</i>	23,71	2533,645	0,937 (mean) $\pm$ 0,0279 (std)

It is seen from Table 2 that among simple linear models, the Ridge regression model showed the best result for all the quality metrics under consideration.

It is seen from Table 3, that among the wooden models, the best result for all the considered quality metrics was shown by a model based on boosting – *GradientBoostingRegressor*. The model with the use of bagging – *RandomForestRegressor* coped a little worse.

Conclusion

The most promising model was the *Gradient Boosting Regressor*, which provides the minimum absolute and quadratic errors, as well as the maximum

mean metric R^2 and the minimum spread (std) on 10 data segments.

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MATHEMATICS

BOUNDARY VALUE PROBLEM FOR THE THIRD-ORDER EQUATION WITH MULTIPLE CHARACTERISTICS

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Abstract

The article constructs a unique solution to a tertiary-order equation with multiple characteristics with boundary conditions that include all possible local boundary conditions. The uniqueness of the solution of boundary value problems is proved by the method of integral equations using the sign-definiteness of quadratic forms. When proving the existence of a solution to the problem, the Green's function method, the theory of integral equations and potentials are used.

Keywords: Boundary value problems, third order equation, multiple characteristics, quadratic forms, uniqueness of solution, existence of solution, Green's function, potential theory, fundamental solution.

Introduction. In recent years, the desire for mathematical justification of natural phenomena is connected with the study of their mathematical models. For example, the compilation of mathematical models of wave propagation with large amplitudes, tsunami propagation in the oceans, nonlinear wave propagation in shallow waters, hydro-magnetic wave propagation in cold plasma and acoustic waves in anharmonic crystals is connected with linear and nonlinear equations of odd order ([1]-[6]). Therefore, the study of an odd-order equation with different boundary conditions is one of the urgent problems. Since the third-order equation de-

scribes the propagation of non-standard waves in various media, it is precisely here that a study is required to study the asymptotic properties of solutions to these equations. One of the methods of such research is the Saint-Venant principle, which occupies a special place in the theory of elasticity ([7]-[12]). To investigate the asymptotic properties of solutions to boundary value problems using the Saint-Venant principle, it is necessary that a solution to this problem be constructed in a bounded domain. Therefore, the problem under consideration in the proposed article is relevant.

Formulation of the problem and main results.

The purpose of this article is to study the equations

$$Lu \equiv \frac{\partial^3 u}{\partial x^3} - \frac{\partial^2 u}{\partial t^2} = 0, \quad (1)$$

In area $\Omega = \{(x, t) : 0 < x < 1, 0 < t < T\}$. Equation (1) is one of the representatives of the third order equation with multiple characteristics. It is known that the fundamental solutions of Eq. (1) have the following form [13].

$$U(x - \xi; t - \tau) = |t - \tau|^{1/3} f\left(\frac{x - \xi}{|t - \tau|^{2/3}}\right), \quad x \neq \xi, t \neq \tau; \quad (2)$$

$$V(x - \xi; t - \tau) = |t - \tau|^{1/3} \varphi\left(\frac{x - \xi}{|t - \tau|^{2/3}}\right), \quad x < \xi, t \neq \tau. \quad (3)$$

Here

$$f(z) = \frac{2}{3}|z|^{1/2} \int_z^\infty \eta^{-3/2} f^*(\eta) d\eta + c^+, \quad z > 0,$$

$$f(z) = \frac{2}{3}|z|^{1/2} \int_{-\infty}^z \eta^{-3/2} f^*(\eta) d\eta + c^-, \quad z < 0,$$

$$\varphi(z) = \frac{2}{3}|z|^{1/2} \int_{-\infty}^z \eta^{-3/2} \varphi^*(\eta) d\eta + c, \quad z < 0,$$

$$f^*(z) = \int_0^\infty \exp\left(-\frac{\lambda^{3/2}}{\sqrt{2}}\right) \cos\left(\frac{\lambda^{3/2}}{\sqrt{2}} + \lambda z\right) d\lambda, \quad -\infty < z < \infty,$$

$$\varphi^*(z) = \int_0^\infty \exp\left(\lambda z - \lambda^{3/2}\right) dz + \int_0^\infty \exp\left(-\frac{\lambda^{3/2}}{\sqrt{2}}\right) \sin\left(\frac{\lambda^{3/2}}{\sqrt{2}} + \lambda z\right) d\lambda, \quad z < 0,$$

$$z = (x - \xi)|t - \tau|^{-2/3}.$$

Here C^+ , C^- – integral constants in the positive and negative parts of the axis z respectively.

Functions $f(z)$, $\varphi(z)$, $f^*(z)$, $\varphi^*(z)$ is called the Airy functions for which the relation

$$f''(z) + \frac{2}{3}zf^*(z) = 0, \quad \varphi'''(z) + \frac{2}{3}z\varphi^*(z) = 0,$$

$$\int_{-\infty}^\infty f^*(z) dz = \pi, \quad \int_{-\infty}^0 f^*(z) dz = \frac{2\pi}{3}, \quad \int_0^\infty f^*(z) dz = \frac{\pi}{3}, \quad \int_{-\infty}^0 \varphi^*(z) dz = 0.$$

In domain Ω consider equation (1) with the boundary condition:

$$u(x, 0) = \psi_1(x), \quad u(x, t) = \psi_2(x), \quad 0 \leq x \leq 1, \quad (4)$$

$$\alpha_1(t)u(1, t) + \alpha_2(t)u_{xx}(1, t) = \varphi_1(t), \quad u_x(1, t) = \varphi_2(t), \quad 0 \leq t \leq T \quad (5)$$

$$\beta_1(t)u(0, t) + \beta_2(t)u_x(0, t) + \beta_3(t)u_{xx}(0, t) = \varphi_3(t), \quad 0 \leq t \leq T \quad (6)$$

We note that we considered similar problems in [14], [15] only for third-order equations of a different form.

Theorem 1. Let the following conditions be satisfied

$$\alpha_2 \neq 0, \quad \beta_3 \neq 0, \quad 2\beta_1\beta_3 - \beta_2^2 \geq 0, \quad \frac{\alpha_1}{\alpha_2} \leq 0.$$

Then problem (1)-(4) does not have more than one solution in the class $u \in C_{x,t}^{3,2}(\Omega) \cap C_{x,t}^{2,1}(\bar{\Omega})$

Let problem (1), (4)-(6) have two solutions $u_1(x, t)$, $u_2(x, t)$. Then assuming $v(x, t) = u_1(x, t) - u_2(x, t)$ we obtain the following homogeneous problem with respect to the function $v(x, t)$.

$$Lv \equiv \frac{\partial^3 v}{\partial x^3} - \frac{\partial^2 v}{\partial t^2} = 0, \quad (x, t) \in \Omega,$$

$$v(x, 0) = 0, \quad v(x, t) = 0,$$

$$\alpha_1(t)v(1, t) + \alpha_2(t)v_{xx}(1, t) = 0, \quad v_x(1, t) = 0,$$

$$\beta_1(t)v(0, t) + \beta_2(t)v_x(0, t) + \beta_3(t)v_{xx}(0, t) = 0.$$

Consider the identity

$$\int_0^1 \int_0^1 L(v) v dx dt = 0.$$

Integrating by parts, we get

$$\int_0^1 \int_0^1 v_t^2(x, t) dx dt + \int_0^1 \left(\frac{\beta_1}{\beta_3} v^2(1, t) + \frac{\beta_2}{\beta_3} v_x(1, t)v(1, t) - \frac{\alpha_1(t)}{\alpha_2(t)} v^2(0, t) + \frac{1}{2} v_x^2(1, t) \right) dt = 0.$$

Hence, by virtue of the conditions of the theorem, the quadratic form

$$Q(t) \equiv \frac{\beta_1}{\beta_3} v^2(1, t) + \frac{\beta_2}{\beta_3} v_x(1, t)v(1, t) + \frac{1}{2} v_x^2(1, t)$$

will be positive definite, i.e. quadratic form $Q(t)$ can be written in the following form:

$$\frac{\beta_1}{\beta_3} v^2(1, t) + \frac{\beta_2}{\beta_3} v_x(1, t)v(1, t) + \frac{1}{2} v_x^2(1, t) = \lambda_1 v_x^2 + \lambda_2 v^2, \quad \lambda_1 > 0, \quad \lambda_2 > 0.$$

Here λ_1 and λ_2 – roots of the characteristic polynomial of a matrix of a quadratic form Q . Then, by virtue of the conditions of the theorem we have $v(x, t) = 0$ in Ω , and due to the continuity of the function $v(x, t)$ in $\bar{\Omega}$ we get that $v(x, t) = 0$ in $\bar{\Omega}$.

Theorem 2. Let the conditions of Theorem 1 be satisfied and the following conditions

$$\psi_1(x), \psi_2(x) \in C^1([0, 1]); \varphi_1(t) \in C^1([0, T]); \varphi_2(t), \varphi_3(t) \in C([0, T])$$

Then problem (1) (4)-(6) has a unique solution in class $u \in C_{x,t}^{3,2}(\Omega) \cap C_{x,t}^{2,1}(\bar{\Omega})$.

The proof of Theorem 2, i.e. the existence theorem, the solution of problem (1), (4)-(6) is carried out by the Green's function method using the theory of potentials of fundamental solutions of equation (1) and on the basis of the theory of the system of Fredholm integral equations of the second kind.

Conclusions. Based on the research, the following conclusions can be drawn:

– In the proposed method for studying boundary value problems, we will apply all possible local boundary value problems for equations (1), since the boundary condition (5), (6) includes all possible boundary conditions;

– based on the results of this work, one can study the asymptotic properties of solutions to equation (1) in the neighborhood of infinitely distant points of the boundary and irregular points of the boundary;

– Based on the results of this work, it is now possible to construct a solution to boundary value problems in unbounded domains.

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PEDAGOGY

ПРОБЛЕМА ОРГАНІЗАЦІЇ САМОСТІЙНИХ ЗАНЯТЬ ФІЗИЧНОЮ КУЛЬТУРОЮ ЗДОБУВАЧІВ ВИЩОЇ ОСВІТИ В УМОВАХ ВОЄННОГО СТАНУ

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THE PROBLEM OF ORGANIZING INDEPENDENT PHYSICAL EDUCATION OF HIGHER EDUCATION ACQUISITIONS UNDER THE CONDITIONS OF MARITAL STATE

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Анотація

У статті розглянуто проблему організації самостійних занять фізичною культурою здобувачів вищої освіти різних рівнів в умовах воєнного стану. Розроблено покрокові рекомендації щодо організації такої роботи, а саме врахування можливостей доступу до матеріалів, добірка або створення доступного контенту, диференціація матеріалу, щоденник.

Abstract

The article examines the problem of organizing independent independent classes in physical culture of students of higher education of various levels in the conditions of martial law. Step-by-step recommendations for the organization of such work have been developed, including consideration of access to materials, creation and selection of accessible content, material differentiation, and a diary.

Ключові слова: самостійність, фізична культура, дистанційне навчання.

Keywords: independence, physical education, distance learning.

Сьогодні в Україні питання збереження здоров'я нації є першочерговим одразу після збереження життя. Ця проблема ще довгий час буде залишатись актуальною, особливо це стосується молодого покоління, на яке ляже основне навантаження з відбудови нашої країни у найближчі роки.

Як не прикро, найбільш вразливою категорією щодо здоров'я є студентство, бо під час навчання у закладах вищої освіти різних рівнів виникає низка проблем і труднощів, до яких, услід за дослідниками (Р. Слухенська, Н. Куліш, В. Маланий, В. Бамбурак) відносимо невисоку рухову активність, через необхідність перебування значної кількості часу в статичній позі, зокрема, сидіння за столом; збільшення навчального навантаження; проблеми в соціальному та міжособистісному спілкуванні [2, с. 195].

Реалії сьогодення додають до цих труднощів необхідність переховуватись тривалий час у обме-

женому просторі, наприклад, переховуватись у бомбосховищах чи укриттях, які не завжди дозволяють вільно рухатись; неможливість перебувати довгий час на вулиці, прогулюватись, займатись звичними фізичними активностями тощо.

Часткова компенсація обмеженості рухової активності студентства відбувалась на дисципліні «Фізичне виховання», під час якої у закладах вищої освіти різних рівнів застосовувались різні засоби підвищення рухової активності.

Однак, з 2020 року в Україні розпочався довготривалий карантин через пандемію Covid-19 і заклади освіти перейшли переважно на дистанційну форму, заняття проводились на різних освітніх платформах «Moodle», «Microsoft Teams», або за допомогою сервісів «Zoom», «Google meet» та ін.

На превеликий жаль, навіть після завершення карантину нам не вдалося повернутись до повноцінного життя через повномасштабне вторгнення росії й ми змушені продовжувати навчання здобу-

вачів освіти переважно онлайн. Як справедливо зазначили автори публікації «Фізична культура у вищих навчальних закладах в умовах карантинних обмеженнях», услід за О. Томашук, В. Сенько, «Відповідно до нинішніх реалій така дисципліна як фізична культура постала перед проблемою своєрідної неповної реалізації, оскільки комп'ютер, домашні умови карантинних обмежень не можуть замінити спортзал, тренувальні майданчики та стадіон, які раніше були звичними локаціями для проведення занять» [3, с. 64]. Ситуація ускладнена тим, що на відміну від часів карантину, зараз неможливо проводити заняття онлайн через віялові відключення світла та інтернету, повітряні тривоги тощо.

Тож перед викладачами фізичної культури постає нове завдання: максимально залучити здобувачів освіти різних рівнів до самостійних занять фізичною культурою.

У нашому дослідженні ми будемо розглядати самостійну роботу фізичною культурою не як частину опанування освітнього компонента, а як самостійну організацію фізичної діяльності взагалі.

Проблема мотивації й організації самостійної роботи здавна турбує педагогів, психологів, методистів. Її активно досліджували С. Гончаренко, І. Зязюн, О. Жерновникова, Г. Юшко та ін.

Зважаючи на специфіку організації занять фізичною культурою (необхідність розуміння послідовності виконання тих чи тих вправ, необхідного й достатнього навантаження, робота над усіма групами м'язів та ін.), пересічному здобувачеві важко самостійно провести для себе повноцінне заняття, тож виникає необхідність організації спеціального педагогічного супроводу такої роботи. Саме викладач дисципліни «Фізична культура» може й повинен організувати такий супровід, який має ґрунтуватися на сучасній теорії навчання й виховання, аналізі сучасних досягнень психології, новітніх інтерактивних засобів і технологій тощо.

До покрокової організації такої роботи можемо віднести:

Урахування можливостей доступу до матеріалів або вибір доступної платформи. Кожен викладач добре знає, яка платформа є найбільш зручною для здобувачів, однак, досвід роботи засвідчує, що краще розмішувати матеріали одразу на декількох платформах. Таке дублювання збільшить можливість доступу й використання.

Добірка або створення доступного контенту. Викладачі можуть заперечити, що в них відсутній час і можливості розробляти, записувати відеоконтент. Зауважимо, що на сьогодні така проблема зовсім не стоїть гостро. Адже ми маємо на увазі переважно добірку адекватного контенту й розміщення його на загальнодоступній платформі. Однак, за бажанням викладач може створити й власний контент, що ще більше стимулюватиме здобувачів освіти. Багаторічний досвід роботи у закладі вищої освіти дозволяє стверджувати, що часто на опис вправ не звертають уваги, а їх демонстрація і словесний коментар сприяють більш точному і правильному виконанню. Тому ми зупиняємось саме на відеоконтенті, оскільки фізичні вправи вимагають їх

абсолютно правильного виконання. Під час добору відеоконтенту можна скористатись матеріалами Всеукраїнського проєкту «Junior» для вчителів фізичної культури «Онлайн-уроки з Junior». Таким, що заслуговує є проєкт «Діджитал-фізкультура для школярів за участі зірок спорту» (https://osvita.diia.gov.ua/courses/digital-fizra?fbclid=iwar08iqbhaqv7_wrbwtww9tdmq_dagptvm9dj1kl97__qm7lkcjvntthove). У цьому проєкті відомі особистості демонструють виконання планки, випадів, згинання – розгинання, стрибки, біг на місці, набивання м'яча та ін. Особливо корисним у цьому проєкті є демонстрація використання смартфонів як мінітренера, що вважаємо сьогодні надзвичайно актуальним. Наголосимо, що хоча ці проєкти призначені для школи, їх цілком можна використовувати й у вищій школі з методичними рекомендаціями викладача.

Диференціація контенту. Здобувачі освіти будуть більш зацікавлені ставитись до завдань, якщо бачитимуть спрямованість на ті чи ті свої якості. До прикладу, можна зробити розподіл завдань для юнаків та дівчат, або «Для тих, хто віддає перевагу «важкому», «Для тих, хто хоче бути гнучким», «Для тих, хто хоче активності» тощо. Вважаємо доцільним буде й використання стандартних назв за видами «Силові вправи», «Аеробіка», «Стрейчинг/Розтяжка» тощо. Вважаємо цікавою можливість розробити тижневе тренування для кожного дня, тоді такі підрозділи можуть мати відповідну назву: «понеділок», «вівторок», «середа», «четвер», «п'ятниця». Зазначимо, що не варто здобувачів перерантажувати вибором, оскільки психологи (Б. Шварц) стверджують, що існує «парадокс вибору»: чим більше вибір, ти менша ймовірність, що людина буде ним задоволена [1].

Щоденник. Викладач може створити щоденник для заповнення здобувачем, у ньому можуть бути передбачені різні варіанти: наприклад, там можна відмічати щоденне виконання ранкової зарядки, або повноцінного фізичного тренування. Вважаємо подвійну реалізацію цієї ідеї, який можна реалізувати за допомогою спільного google-документа на google-диску. Такий щоденник може бути індивідуальним, тобто кожен здобувач може заповнювати його самостійно відповідно до виконання фізичних активностей. Або це може бути спільний щоденник, у якому буде видно активність всієї групи здобувачів, наприклад, у рядку «ранкова зарядка», кожен, хто зробив зарядку ставить «+». Так само це стосується й інших активностей. Крім іншого, такий щоденник дозволить викладачеві відслідковувати, які активності користуються попитом, проаналізувати загальну активність, вислідкувати її динаміку чи занепад тощо. Цікавою ідеєю є також створення спільної групи у месенджерах чи соціальних мережах, де можна викладати фіксацію власних тренувань: відео чи повідомлення. У такому випадку, на нашу думку, прикладом, перш за все, має виступати сам викладач.

Отже, сьогодні в Україні надзвичайно гостро стоїть проблема організації самостійних занять фі-

зичною культурою здобувачів вищої освіти в умовах воєнного стану, оскільки студентство позбавлене можливостей регулярно займатись фізичною культурою під час аудиторних занять через низку об'єктивних причин. Тому на викладача цього освітнього компоненту полягає важливе завдання – допомога в організації самостійних занять та їх стимулювання. Пропонуємо для вирішення цієї проблеми максимально зручно організувати роботу здобувачів: обрати найбільш зручну для користування освітню платформу чи декілька; дібрати чи розробити максимально доступний і зрозумілий відеоконтент, диференційований за певними ознаками; створення щоденника або груп у соціальних мережах чи месенджерах.

Перспективи подальшого дослідження вбачаємо в розробці системи самостійних занять з фізич-

ної культури для майбутніх фахівців окрім спеціальностей 014.11 Середня освіта. Фізична культура та 017 Фізична культура і спорт.

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PHILOSOPHY

DEVELOPMENT OF JOURNALISM IN THE PHILOSOPHICAL SPACE

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Abstract

The article analyzes the emergence and development of journalism in the philosophical space. Journalism in the philosophical space has historically manifested itself in various modifications, such as philosophical journalism, philosophical journalism, philosophical magazine, media philosophy, visual philosophy. This topic has not yet found a sufficiently comprehensive study both in philosophy and in the works of media analysts, although the relevance of such a study is undoubted, since new realities have emerged: such as the information society, media reality, media philosophy, etc.

Keywords: philosophy, journalism, mass media, philosophical journalism.

The philosophical analysis of journalism was actualized in the late twentieth and early twenty-first centuries. This circumstance is due, first of all, to the fact that journalism has begun to touch almost all spheres of human and social life. There is no sphere of society where journalism does not intervene. Thanks to this, it has a radical impact on the social, professional, educational, political, and spiritual spheres of life. Journalism has also touched upon such a sphere of spiritual production as philosophy. Philosophy and journalism are socio-cultural phenomena, but their connection began only at the end of the eighteenth century. The origins of this connection are born with the appearance of the first printed media in Europe - newspapers and magazines. The relationship between philosophy and journalism becomes part of the discourse on its philosophical understanding. This discourse is historical and dynamic. Journalism today is a part of the mass media poly-system, multifunctional institutions of society, such as the press, television, radio, and the Internet, i.e., there are various types of journalism. Hence, it is necessary to determine their correlation, connection with philosophy, and the role of journalism in the philosophical space. This aspect is the purpose of the article. So far, there are no special substantiated studies on this issue, although two international conferences have already been held at St. Petersburg University on media philosophy (2007) and the historical development of philosophical journalism (2010). The theoretical foundations for analyzing journalism in the philosophical space are presented in various aspects in the works of such well-known philosophers and media analysts as M. McLuhan, J. Brodriard, D. Rushkoff, F. Fukuyama, L. Lesh, L. Pento, G. Pocheptsov, I. Mykhailyn, V. Mironov, A. Carmine, V. Fedotova, V. Podorozha, V. Dubrovsky, V. Savchuk, M. Shlemkevych, O. Sobol, M. Luhmann, I. Pavlyk, M. Emery, L. Zamaleev, A. Ivanenko, V. Prolyev, I. Smirnov, M. Stepanov, and others.

It should be noted that in the works of media analysts, and above all on the pages of the International

Journal "Gazeta", it is said that the theory of journalism, the understanding of journalism proposed in the early twentieth century by F. Siebert, T. Peterson and W. Schramm in their work "Four Theories of the Press" cannot satisfy modern researchers and be relevant to modern reality. Recent scholarly works, both foreign and domestic, emphasize the understanding of journalism as a component of communication studies, a means of communication and communication. It was this point in the analysis of philosophical journalism that was emphasized at the conference at St. Petersburg University in November 2010.

Journalism in the philosophical space manifests itself as a philosophical journal, as a means of professional communication. One cannot but agree with the point of view of Russian researchers that the philosophical journal is becoming one of the important institutions capable of ensuring both the communication of the philosophical community and the interaction of philosophy with other areas of social and humanitarian knowledge [1, p. 227].

Philosophical journalism and philosophical journals have become a kind of being of philosophy since their inception, just as the novel became such a being in the second half of the nineteenth century.

In his article "Philosophical Journalism" in the journal "Sociologos" in 1997, the French philosopher L. Pento noted that journalism as a component of the media interferes with such an esoteric sphere as philosophical production, appropriates a special form of competence, although it seems to claim secondary roles, chooses stars, topics, and titles. Journalists seem to only describe what is happening before their eyes and without their participation. This invasion is not limited to the frontier, it concerns the impact on the entire field of spiritual production [8]. The author raises a very important problem: allegedly, not explicit interference in philosophy actually leads to a weakening of internal control, philosophy is interpreted in such categories as hybridity, parasitism, and mingling, and philosophy

loses its identity. L. Pento's opinion should be emphasized that nowadays there is a situation where philosophical journalism is no longer perceived as marginal, it is intended to become part of the usual attributes of the career of a new mandarin, trying to put philosophy under control, falsifying the image of philosophy and philosopher [8]. There is a deprofessionalization of philosophy, as emphasized by postmodernists. Thus, R. Rorty stated in his work "Philosophy and the Future" that there is no need to care about the purity of philosophy [9]. Ortega y "Gasset" drew attention to the deprofessionalization of philosophy even earlier, noting that philosophers are becoming everything: politicians, teachers, writers, researchers, but not philosophers [6]. According to M. Luhmann, R. Rorty, Beck, and L. Pento, philosophical production in the modern world is becoming a commodity, a component of a single world - the commodity world. In this sense, philosophical journalism also becomes a kind of commodity. This circumstance changes the functions of both journalism and philosophy, which is facilitated by the information society.

In today's society, journalism is ready to advertise anything: cars, laundry detergents and clothes, hygiene products, the human body, and even concepts. The philosophy of "revealing simple truths," which is now being polarized in numerous white books by Paulo Coelho, Antoine de Couattier, and many other "interpreters of life," suggests that everything can be sold or bought. And even get a lot of money for it. Not the least role in this is played by the mass media, which distributes, informs and provides the average user with new discoveries today. Like a horoscope that advises to refrain from conflicts today, it creates an everyday philosophy for itself. Almost everyone should realize that philosophy is good and a sign of education. Philosophy is for the masses. Philosophy is for everyone's home. In general, the knowledge that is created and accumulated by a few dissolves among millions. It's like a dish that a professional chef worked to create, and which the whole family enjoys after putting it in the microwave.

This is the influence of magazines on philosophy. This is what Yas Persian called the ability to communicate. This can be considered positive or negative, condemned by highly specialized conservative philosophers, or, on the contrary, proclaimed a geometric progression in the development of philosophy by those who seek to spread it over as many territories as possible. But despite the strong defenses of journalism, or rather, its opening of borders for everything innovative, which, like a snowball, merges into something big and influential, philosophy also has something to contribute to the postulates. At the moment, we can talk about the creation of so-called intellectual journalism - philosophical journalism. Those experts in words and their work who have gone beyond the dryness of news reports and the objectivity of analytical articles can safely refer their publications to this type of journalism. Unlike philosophers, who give up the simple in favor of a complex and deeper comprehension of things, they tackle the problems of everyday life that require subjective thought. Many university philosophy graduates have the ability and desire to try their hand at the press,

and no fewer journalists prefer philosophical essays. Freed from the constraints and requirements of the journalistic genre, they create their own concepts of seeing the world, combined with professional experience and knowledge of life. Perhaps they are even more productive than philosophers themselves, taking advantage of the many masks that journalists have to wear in their daily work. But on the other hand, this can lead to ambiguity in their views, variability of opinion, and instability of position.

The new turn in philosophical journalism was almost universally welcomed by young professionals. For example, an electronic literary and philosophical almanac of students of the Moscow State University's journalism faculty is available on the Internet, and they characterized it with the following apt statement: "Journalism is a curved line, while philosophy is a set of segments, each of which ends with a large number of original segments." To decipher their thought, we can say that journalism is a planned path characterized by the typical features of all genres: relevance, informativeness and efficiency. It never compromises these postulates, only sometimes changing the vector of its direction depending on the surrounding circumstances. Philosophy creates many thoughts, many concepts, which can either be in the same plane or never meet. And each new thought is at the same time a space for new disputes, new views, and, as a result, new branches (segments) of the philosophical current.

Philosophy is currently in an ambiguous position. Secular literature? Intellectual writing that divides people into "those who are in the know" and "those who are not"? Is it possible that the popularization of journalism only stimulates its development? The influence of philosophy on the fourth power can be evaluated positively - commentators have learned to think with their own worldview in mind. Philosophical journalism = literary culture? Many questions, and not only these, will arise for those who discover the ability to philosophize in life. How to solve them is up to both the journalist and the philosopher, because each of them already has the right to think subjectively.

The emergence of media reality presents multiple images, a new configuration of philosophical journalism. Not only professionals become the subjects of philosophical journalism, it is open to specialists in various fields, and it takes on the expression of a kind of intellectual game. According to L. Pento, philosophical journalism is becoming a cultural form par excellence, thanks to which mediators, people who cross borders and make transitions, whether they are journalists, writers or university professors, contribute to making free circulation in the intellectual field collectively acceptable [8, p. 30-35]. This is the meaning of philosophical journalism as a free means of communication, both professional and cultural, and public in general. In today's philosophical situation, a philosophical journal acquires the character of intercultural communication.

Philosophy has always been interested in the relationships between people, their interaction and mutual influence, not just communication in itself, but its role in education, science, and culture. Philosophical jour-

nalism is a very important tool in this process, as evidenced by the dynamics of philosophical journal publishing in the world in the twentieth century.

At the beginning of the First World War of 1914-1918, more than 40 philosophical journals were published in the world; during the war, the publication of many philosophical journals was interrupted, and some ceased to be published. In 1919-1939, 57 new philosophical journals appeared in Germany, Italy, France, and the United States; they began to be published in China, Australia, and India; specialized philosophical journals on the logic and methodology of science appeared ["Erkenntnis" (Lpz., 1930-1940); "Philosophy of Science" (Bat., since 1934); "Theoria" (Goteborg, since 1935)].

During the Second World War (1939-1945), 21 philosophical journals ceased to be published. New philosophical journals were created mainly in the United States. In the postwar years, the number of journals increased: in 1945-1950, 37 new philosophical journals were created, in 1950 - about 50, in 1951-1960 - also about 50, in 1960-1966, about 40 new journals began to be published. During this period, philosophical journals appeared in a number of Latin American countries (Argentina, Chile, Brazil, Mexico, Ecuador), Pakistan, and India; there was a further specialization of philosophical journals in the history of philosophy, aesthetics, methodological problems of social sciences, ethics, and logic; abstract philosophical journals and new international philosophical journals were created. The main trend in the development of philosophical journalism is the doubling of their total number in 15-20 years (in 1850 - 4, 1870 - 9, 1890 - 19, 1910 - 38, 1930 - 58, 1950 - 97, 1970 - about 200).

At the beginning of the XXI century philosophical journals are published in Russian - 15, in English in Australia - 1, England - 8, the Netherlands - 2, Norway - 1, the USA - 22, international philosophical journals - 7, in German - 1, in Germany - 19, in French in Belgium, France, Canada - 15, as well as 7 international ones, in Spanish - 1, in Italian - 28, philosophical journals are published in Bulgaria - 2, Brazil - 2, Poland - 4, Romania - 1, Finland - 1, Estonia - 1. As for Ukraine, "The Ulrich's international" listed only one philosophical journal in 1970 [3]. But the situation with philosophical journalism has changed. Philosophical journals are published in almost all universities of the country, although, unfortunately, there is no list of them, since most of them are published at the expense of teachers and graduate students. Why do we have this situation? According to S. Proleyev, who stated this in his article "The Purpose of a Philosophy Journal in the Mirror of Statistics," the manifestation of this state of philosophical journalism in Ukraine is the rapid decline of philosophy and related disciplines in the structure of university education. We have a situation of a kind of "shagreen skin" that is shrinking in size so rapidly in the course of the national university situation that the entire twenty-five-century-old respectable philosophical tradition, this intellectual core of European history, will soon be left in Ukrainian universities as a small patch, suitable only for covering up for the current situation, as even savages do. It seems that even today,

Ukrainian educators and university administrators do not get rid of this thing only out of shyness, not seeing any other useful, educational role for philosophy [7, p. 138].

It should be noted that this is almost the only comprehensive article in recent years, both at the end of the twentieth century and not at the beginning of the twenty-first century, not only about the fate of the Ukrainian philosophical academic journal "Philosophical Thought" but also about the fate of philosophy. This idea is also present in V. Anashvili's interview with the Russian Journal. He emphasizes that without a number of qualified journals of multiple "orientations" and several "national" humanities journals, we will face a scientific turning point [4, p.7]. Analyzing the state of philosophical journalism in Russia, he draws a very pessimistic conclusion: the Philosophy Faculty of Moscow State University publishes the "Bulletin of the Philosophy Faculty" with a circulation of 6300 copies, and this is Moscow State University - it is a world university. And its journal should be appropriate, large-scale, if not international. "Questions of Philosophy" and "Philosophical Sciences" have long since lost the nerve of modern humanitarian journalism, gloomily returning to the style and themes of long gone times [4, p. 10].

The authoritative Philosopher's Index, which has existed since 1967 and is updated every three months, still does not include Russian journals and yearbooks. According to Yu. Sineokoya, this can be explained by the publishers' disinterest, not always reflected by the emphasis on self-sufficiency, hermeticity, and absence in the global professional dialogue on equal terms [10, p. 115]. Ukrainian philosophical periodicals are also absent from the index. The reasons for its absence are similar to those of the Russian ones.

The position of S. Proleyev, V. Anashvili, and Y. Syneokoya is shared by V. Porus, who believes that there is a contradiction between the many thousands of professional philosophers and the small number of philosophical journals, their number is pathetic and cannot be compared with the situation in some European countries. He makes a rather harsh statement that even this "insignificant" journal production by modern standards is filled with compilation and abstract descriptions, against which high-quality works become an exception. The philosophical journal becomes a means of producing "complicated" personnel who lose their purpose. That is why, according to V. Porus, our journals cannot be called avant-garde.

Analyzing philosophical journalism, it should be emphasized that in the information society it is a component of the mass media. N. Luhmann drew attention to this fact, emphasizing that the concept of mass media should cover all social institutions that use technical means of dissemination to disseminate messages, that the products of mass media are newspapers, magazines, photocopies, etc., but not manuscripts written in dictation in the Middle Ages, and not public speeches and stories in our time. Distribution technology has played an important role in the process of separating the mass media system, just as money played a role in relation to the economy [5, p.15].

The modern information reality has made significant changes in the theory and practice of journalism and philosophical understanding of communication. Philosophical journalism is becoming more and more the subject of scientific analysis due to a number of socio-cultural circumstances. The understanding of the very phenomenon of "journalism" has changed. It is becoming a structural element of the mass media.

Philosophical journalism is one of the professional means of communication and should be classified as a scientific type, since philosophy has the status of a science. At the same time, philosophical journalism can be interpreted as a kind of corporate culture. From this perspective, there is no analysis of philosophical journalism, although it is quite relevant. It is relevant because it raises the question: is philosophical journalism only and only for specialists, or is it changing its status and becoming public? The analysis of scientific publications (a rather small number) shows that the interpretation of philosophical journalism has two directions: classical and post-classical, tradition/innovation. While the classical trend in philosophical journalism is associated with its emergence in the bosom of German philosophy, the post-classical trend is associated with the emergence of post-classical philosophical thought, and above all, postmodernism.

Modern media technologies are changing the configuration of philosophical journalism. At the beginning of its emergence in European culture in the late eighteenth and early nineteenth centuries, philosophical journalism existed as mono-journalism, only as a magazine, as a book. This model of a philosophical journal was embodied in the late nineteenth century in the "Philosophical Three Monthly" published at Kyiv University by Professor V. Kozlov. It was the first philosophical journal to appear at that time in both Ukraine and Russia. V. Kozlov's journal is an analog of the philosophical journals published by F. Schelling in Germany, which became the birthplace of philosophical journalism. It was this country that initiated journalism as the existence of philosophy. F. Schelling synthesized philosophy and journalism, and he can undoubtedly be considered the first philosopher-journalist. The beginning of journalism in Ukraine is associated with the Kharkiv Imperial University in the first quarter of the nineteenth century. I. Mykhailyn, analyzing the first magazines in Slobozhanshchyna and Ukraine, proves their important feature: the essence of philosophical topics. This applies to such first journals as Democritus, Ukrainian Journal, and the journal Faith and Reason made a significant contribution to the philosophical space. It was the first philosophical journal in the Russian Empire. An interesting and rather fruitful opinion in this regard is that of the Russian researcher L.F. Zamaleev, who noted that without the support of journalism in the first half of the nineteenth century, the formation of philosophy would not have taken place in the Russian Empire, and that, in the words of G. Florovsky, there would not have been a philosophical "icebreaker". The periodicals of the twelfth century discussed the meaning of philosophy as wisdom, and created philosophical movements and trends. The whole color of the

university professors is organized into newspapers and magazines [2].

In this context, the opinion of the famous Ukrainian philosopher and journalist M. Shlemkevych is worthy of attention. In 1948, he published an article "Organ of Public Opinion (Ideas for Philosophical Journalism)" in the foreign journal "Problems", in which he proves that the worldview of the Ukrainian nation was built and created by publicists and journalists, not philosophers, which is typical for Germany and France, where it was formed in academies and universities since the eighteenth century [11].

Media reality presents multiple images, a new configuration of philosophical journalism. It is becoming a kind of media philosophy, presenting itself as an online magazine, a blog, a visual image, etc. Technology is becoming the main factor that not only determines the development of new configurations of philosophical journalism, but also the means of its manifestation. As a result of this situation, scientific contacts and scientific cooperation overcome national and regional borders and become communication without borders. Intercultural scientific communication and intercultural scientific interaction are taking place. According to Yu. Sineoka, since 1980 philosophical periodicals have increasingly played the role of moderator of philosophical discourse. This applies to both experimentation with the identification of philosophy by appealing to the language of politics, art, psychotherapy, etc. and the expansion of the space of philosophy itself, the construction of new disciplines [10, p. 135].

Thus, in modern conditions, philosophical journalism is an important element of mass media. It is one of the means of scientific communication that presents a new configuration in the information society. Philosophical journalism presents itself as a book, as an online magazine, changing the means of ineffective communication, turning any problem that worries people into a commodity and entertainment in the global communication space, setting a new configuration of philosophy, acting as an alternative to its classical academic image.

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SOCIAL COMMUNICATION STUDIES

AN OVERVIEW ON THE DEVELOPMENT OF ADVERTISING IN EGYPT, THE UK, AND BELARUS

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Abstract

This article is meant to provide some initial notions, materials, and concept for the study of advertising. It draws on advertising literature in three countries Egypt, the UK, and Belarus. I committed to bridging the gap between the huge body of research on advertising in the three countries. The history of advertising is particularly explained in these three countries briefly. We need to understand how advertising was formed and legalized in these countries in order to arm ourselves with knowledge about practical, historical, and legal forms of advertising. In this article I wanted to answer the question who invented the art of advertising? How is advertising shaped in Egypt, the UK, and Belarus, historically, legally, and literary? Advertising has an impact on our lives, our perspectives, and feelings. This article aims to provide researchers with some knowledge about the development of the advertising processes to imagine and understand the amount of devolvement was achieved and investigate this field of advertising as well as how it influences and shapes our social lives.

Materials and Methods: The study is based on publications by Arabic, English and Belarusian authors, which highlight on advertising, its history, and its literature. General scientific and special research methods were used in the course of the study.

Findings and Discussions: After studying the scientific works presented in the article, the author identified the issues that are raised in these scientific studies, such as the initial of the advertising and special attention paid to the development of advertising in these three countries and its various characteristics and approaches.

Keywords: Advertising, giant billboards, advertisers, Egyptian advertising, British advertising agencies, Belarus advertising.

Who invented the art of advertising?

The Pharaohs, not the Romans, were the first to invent the art of advertising, it was posted by Dr. M. Al-Sabban. In a thesis on which he was awarded a doctorate, Dr. M. Al-Sabban, (Professor of Design and Advertising at the Faculty of Specific Education at Cairo University) proved scientifically that the Pharaohs were the first

to invent the art of advertising, thus smashing old theories that traced the creation of the foundations of this art to the Greeks and Romans. Through his study, it became clear to him that the ancient Egyptian letters are not symbols as it is well known, but rather forms equivalent to the alphabets, which are closer to forms of nature. During his research, he stopped at the studies that indicated that the Greeks and Romans were the first to invent the art of advertising, so he started working to verify the truth of the matter until he ended up proving that the Pharaohs were the first to know this art in the world. One of the main difficulties he faced was the lack of a reference for the art of advertising with the Pharaohs, which forced him to research, and read about aspects of ancient Egyptian life. In addition to the presence of thousands of artifacts to be studied and the translations of ancient Egyptian writings contained in them to monitor the dimensions of ancient Egyptian thought. Advertising is related to reading and writing. The ancient Egyptians were educated enough to create written advertising messages in various aspects of life that differ from the current vision of commercial advertising. By studying texts, monitoring the events of their daily lives, it became clear the Pharaohs had an innovative advertising vision. For example, it was written on the door of one of the tombs "O living people passing

in front of this place, do not enter it with the intention of distorting it, otherwise the crocodile will wrap around you" which is a clear warning to anyone who dares to tamper with the cemetery. Its contents are very similar to signs that we find in public places, such as "No Smoking" and "Danger of Entry" [1].

In her article on Egyptian civilization, "Political Propaganda in Ancient Egypt," N. M. Ahmed asserted that political propaganda in ancient Egypt was the goal and means for anyone who wanted to reach an important political or religious position, meaning that he was seeking to include the largest number of popular support for him by announcing his work or by proving his eligibility for the position, whether through the job order or as a son of a dynasty that monopolized the position [2]. From the previous examples, we can be sure that the pharaohs were the first people on earth who used the art of advertising in order to persuade, warn, or sell something, or an idea.

Tej K. Bhatia in his book, Advertising in rural India (in 2000), highlighted in his study on how pharaohs wrote on special type of papers they called it papyrus which was used by the Egyptians to create posters, letters, and /or to write a notice about lost property. Another example of ancient advertising is wall or rock painting for advertisements, which is still practiced today in many regions.

We pay attention to the tools or means of advertising in old ages. Moreover we would better call them the stages of the improving of advertisements, so papyrus was the first means of advertising, then David Wengrow in his article, Prehistories of Commodity Branding (2008), indicates that about 4000 years ago people started using seals and tags made of stones. In ancient

times, many products were marked with seals or tags. Affixing simple stone seals to goods dates back to around 4,000 years ago; over time, these seals evolved into clay ones with exquisite images, frequently representing the producer's identity. After a long time people started using some maker marks that is around 1300 BC. Then came the Indians, they applied distinguished marks to valuable goods such as precious metals [3].

Advertising in Egypt

Early nineteenth-century advertisements were clichéd and longwinded. However, they continue to be primarily factual and informational in nature. As one might anticipate from an official newspaper, many of the advertisements are for items that the government wants to sell, like surplus goods or stock in its corporations. Additionally, there are advertisements placed by people looking to sell their homes, properties, and books. The majority adheres to a formula in which they outline what is being sold, buyers should get in touch with by a certain date, and state that the item will be sold to the highest bidder. These advertisements were targeted at middle-class and upper-class males who were interested in staying current with the state of the economy. The quantity, frequency, and sophistication of advertisements all increased as more publishers realized the value of using advertising. At the same time, there were an increasing number of businesses, outlets, goods, and services looking for advertising. Then, the first significant boom appeared in the market for patented drugs and cosmetics; however, they were different from English advertisements in that they occasionally mentioned a specific pharmacy. Advertisements blurred the lines between foods, beverages, and even the distinction between food and beauty, telling consumers that they could add vitamins to their hair to restore its beauty and drink wine to increase their vitality. Advertising that was focused specifically on one gender was rare, despite the fact that many ads clearly targeted women. The biggest distinction was the absence of official notices. Then, commercials got fancier, more elaborately decorated, used different fonts, and had better, more frequent sketches as illustrations. Additionally, there was more gender specificity, and they reflected the growth of the middle class and of foreign corporations. Traditional advertising, however, continued to be prevalent during the study period. The indication of a middle class that is expanding and becoming more affluent. The rise in hotel and vacation advertising is one piece of the puzzle in this case. In the past, guidebooks and the foreign press were the main places to find hotel advertisements. The most opulent hotels with a wide range of amenities and services were frequently featured in these advertisements. On rare occasions, advertisements for these upscale hotels would also appear in Arabic periodicals. Advertisements for hotels start to appeal to more modest people. Egypt has become a more significant economic and political force in international affairs. The 1952 Revolution that put Nasser in power, the 1956 Suez Canal nationalization, the 1958 Soviet Union support for the High Dam, and the 1958 union with Syria are all evidence of Egypt's burgeoning vitality. The Egyptian press under-

went major developments, especially the introduction of illustrated magazines, and a significant increase in the number and quality of advertisements [4]. Due to the departure of numerous foreigners (Greek, and Italians etc....), who were significant traders, Egypt's distribution system has undergone a significant change over the past few years. However, there is some debate regarding the worth of the services provided in a developing nation by these trader middlemen. The importance of retail advertising and promotion is minimal. Less than 20% of newspaper advertisements are for retail. The cost of retail advertising is prohibitive for the majority of retailers due to the lack of local news publications, all significant magazines and newspapers are regional. Some department stores make extensive use of circulars to advertise clearance sales. Rarely is direct mail used. Government price controls, the live-and-let-live philosophy, the idea of a limited market, and the maintenance of resale prices are the foundations of retail price policies. Retailers typically don't think that decreasing prices will result in more sales; instead, they aim to make the highest possible gross profit on each transaction. Few retailers are aware of the value of turnover and the idea of maximizing profits by selling a large volume of goods at low prices. Price reductions intended to boost sales at the expense of rivals are typically thought to be unfair. Additionally, many implicit price agreements are in place to prevent price competition among retailers who handle related product lines.

Because of the country's efforts to industrialize, the lack of adequate internal transportation and storage infrastructure, the prevalence of small manufacturers, and the concentration of manufacturing in Cairo and Alexandria, efficient wholesaling facilities are crucial in Egypt. Whole-sellers have traditionally held a privileged position in the marketing of goods in Egypt. When acting as import wholesalers, wholesalers were frequently able to prevent local products from entering the market.

Currently, Giant billboards, endless television advertisements become a staple part of daily life in Cairo. Advertising has always played essential role in Egyptian society, although it has risen in importance and appearance in recent years. The 1970's saw a rise in the use of consumer insights and humor as key selling points in shaping advertisements as a form of entertainment. The innovation in the use of culturally relevant humor evolved into the creation, use and adaptation of advertisement jingles during the 1980's. During the 1990's, Egyptian advertisements, the use of billboards became more popular, advertising major reliance on beauty and feminine appeal, in addition to satire, humor and dramatic plot.

More recently, companies made use of the current rap and trap. Egypt's approach to advertising is still slightly outdated when compared to the rest of the world, mainly due to the fact that we still need to cater to what would be most relevant to and accepted by our society.

Advertising now, even with the added role of the digital medium, it seems as though TV ads and video production are still the leading advertising options for

clients and Egypt's general population. These days, advertising agencies have grown in number and there are different advertising giants leading the field than the days of Tarek Nour's reign. Of such agencies are FP7 Cairo, part of McCann World group etc. It seems as though celebrity and concept-driven video advertisements still play a large role in Egypt's advertising today. That being said, advertising has undoubtedly come a long way – it is just a matter of how the world changes around us that will determine how and where we will go from here.

Advertising in the UK

City heralds: In the urban area, people were not well-educated, heralds were authorized to broadcast advertisements and news. Afterwards people began to hire public callers to act as guides [5]. At the same time, street vendors developed a system made up of street runners in order to market their products [6]. Before the emergence of the mass media, these street performers rendered an important public service [7].

Commercial signage has been used for a very long time. Promotional boards and retail banners appear to have emerged independently in the East. Ancient Egyptians were known to use banners to advertise market days and storefronts. Pub owners in medieval Britain were required to erect boards. In the Middle Ages, paintings were used in a variety of commercial settings. The trade card, wall-mounted posters, and, to a lesser extent, small display ads in newspapers, were the three primary forms of advertising in the UK during the 18th century [8]. A popular form of advertising was trade cards. A single product was described on a tiny printed and illustrated card that merchants and tradespeople distributed to customers. The intention was for them to share it with their friends and family. Since agencies were established in the middle of the 19th century, when they primarily used newspapers and magazines, advertising has grown significantly in the UK. London continues to be one of the most significant advertising hubs in the world even though domestic British agencies were swallowed up and transformed into branches of global corporations in the late 19th century [9].

Midway through the 19th century, advertising started to play a significant role in capitalist economies, relying mainly on journals and papers. With the advent of new media like TV, online platform, and portable electronics in the 21st century, ads expanded quickly.

There were concerns about the "Americanization" of British culture and business due to the influx of millions of American soldiers into Britain during the Second World War. The Marshall Plan made it clear that British industry needed to improve its marketing and management capabilities. The advertising firm JWT London was owned and operated by J. W. Thompson in New York City. JWT London held back from advocating strongly for American design. Instead, it uses subtly persuasive techniques, giving up its uniquely American identity in favor of the understated British style.

T. J. Barratt used the Pears brand as an advertising gimmick because of its high culture and quality. Most notably, he used John Everett Millais' painting *Bubbles* as an advertisement by placing a bar of Pears soap in

the foreground. Barratt continued this theme by associating pears with domestic comfort and aspirations of high society in a series of commercials that featured well-groomed middle-class children. Many of the fundamental concepts that form the cornerstone of effective advertising were first proposed by Barratt, and at the time they were widely accepted.

He pointed out the value of building a strong and exclusive brand image for Pears and highlighting the product's accessibility through saturation campaigns on numerous occasions. He claimed that as tastes and fashions change, the advertiser must adapt. Barratt introduced many of the fundamental ideas that form the basis of successful advertising, and they were widely embraced at the time. He repeatedly emphasized the importance of creating a powerful and specific brand image for Pears and emphasizing the product's accessibility through saturation campaigns. He understood the importance of routinely reevaluating the market for changing preferences and norms when he said that tastes change, styles change, and the advertiser has to adjust with them. An idea that was successful a couple of generations ago would now be outmoded, uncompetitive, and unelectable. The contemporary concept may not always be better than the traditional concept, but it is unique and speaks to contemporary tastes [10].

Due to the new functions that the Internet and smartphones now play, significant changes have recently occurred. Advertising must be truthful and accurate in describing the product or service, as well as ethical, moral, and morally righteous. What advertisers can and cannot do is constrained by laws. You must abide by two advertising codes of practice in addition to the laws if you want to advertise legally. Your product or service must be accurately described [11]. The advertising industry has evolved over time in response to societal and media changes. The system is still being developed based on the guiding principles that advertisements shouldn't deceive, hurt, or offend. The ASA and Ofcom entered into a co-regulatory partnership in December 2009 to regulate the advertisements that accompany video-on-demand services in response to the UK Government's decision that new regulations pertaining to VOD services should be delivered under a co-regulatory framework. Before airing, the vast majority of TV and radio advertisements have already been approved. Additionally, since the industry is committed to effective self-regulation, any advertisements that violate the Codes can be quickly pulled without resorting to legal action. However, if necessary, the ASA can impose penalties to get troublesome advertisers in line [12].

Advertising in Belarus

In Belarus, advertising mainly represents are public interests. However, abroad social advertising is used in full force by non-commercial and commercial enterprises. For example, commercial organizations use social advertising to improve their image. Some commercial organizations place public service announcements for charitable purposes as part of their advertising campaigns. The success of social advertising in Belarus is controversial, so how much of the social advertising relates to politics. In foreign countries, children, family

relationships, hunger in third world countries, refugees and the environment get the advantage in the rating of social advertising. Advertisements organizations with a Belarusian base advertise in Belarus. The state owned for-profit corporations run television, magazines, journals, and newspapers, which rely on advertising, subscription fees, and other sales-related income. Freedom of speech is guaranteed by the Belarusian Constitution. The legal framework for advertising in Belarus is subject to the constitution, media law, international obligations and international treaties. By February 2010, all mass media in Belarus had to be registered under the country's new media law. The Belarusian Ministry of Information, which was established in 2001, monitors the nation's media.

In order to coordinate the interaction of state management, public associations, and other organizations producing mass information, enforce mass-media laws, and provide legal advice, the government established a Public Coordination Council for Mass Information by the beginning of 2009. According to Article 1 of the Mass Media Law, journalists and advertisers receives press credentials by the authorities in order to cover both internal and external event are organized by government agencies or non-governmental organizations, which is normal by most of the countries all over the world. Advertising agencies in Belarus penetrate into people's thoughts and feelings. Designers work on creating an image to visualize the idea and make the advertising effective, while copywriters come up with catchy slogans and texts.

Advertising is specifically created by marketing firms in Belarus for the brand and its target market. Therefore, it is best to consult experts if you want to grab the interest of potential customers. Given that everyone in Belarus uses the Internet, internet advertising is a quick way to draw clients. The Internet offers a variety of advertising options that are available 24/7 for business growth. Online advertising, in contrast to conventional forms of promotion, enables you to monitor consumer behavior and responses and quickly adapt to changes in demand and target audience behavior. Targeting advertising consists of a text ad with an eye-catching image. This type of online advertising is used increase brand awareness, to spread information about events, and market local products. Contextual advertising is a message or a text frame (block) which is reflected in accordance with the advertising site's content. Its main goal is to bring in more target customers and boost sales for already established businesses. Transport-related advertising is a contemporary and varied form of marketing. Nowadays, almost any type of vehicle, including a car, tram, trolley bus, bus, train, airplane, and even a rocket carrier, can have advertising placed on its side.

Conclusion: A major part of raising people's awareness of anything that might be important to them is through advertising. The methods of production and presentation of advertisements have undergone numerous changes over the course of their long history. It is crucial for newcomers and students of advertising to be aware of the history of advertising in Egypt, the UK, and Belarus in order to comprehend how changes have

progressed over time and what potential future changes there may be. The current development of technologies gives advertisers the chance to broadcast their shows more freely. Having three countries (Egypt, the UK, and Belarus) in my study situated in different parts of world gave me a unique chance to conduct study and to answer the question who invented the art of advertising and to see how our cultures differentiate related to an overview of advertising through historical, legal, and literature perspective. In some respects these countries are similar, in others they are different. I conclude that in advertising in these three countries a big progress happened over the recent years. By the beginning of the 21st Century, a big role was played for using technology in advertising. Online advertising, which uses the Internet to promote products and services to audiences, allows people in these countries to find, reach, and engage people who are likely to be interested in your advertising and offers the audience information, so you can focus your efforts effectively. Legal overview is more or less the same in all of these countries, the legal side concentrates on the values, cultural, and moral concepts of the given countries.

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