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SECTION 6. Metallurgy and energy.

DEVELOPMENT OF A FLOW RATE MODEL FOR RETROFITTING OF DAM FOR HYDROELECTRIC POWER GENERATION

Abstract: *Retrofitting is the addition of an existing dam with hydroelectric power generation capabilities. It is a cost- effective way of increasing electricity production. Hydroelectric power generation is the electricity generated by hydropower and the production of electrical power through the use of the gravitational force of falling or flowing water. The cost of hydroelectricity is very low, making it competitive. A dam is used to collect water or for storage of water which can be evenly distributed between locations. Dam serves the purpose of retaining water, while other structures such as floodgates are used to manage or prevent water flow into specific land regions. The acute power outage in Ilorin, the capital city of Kwara state makes most organizations to produce below the optimal level. This research paper develops a flow rate model for retrofitting of ASA dam in Ilorin, Kwara state for hydroelectric power generation. The available theoretical powers, kinetic energy, potential theoretical energy as well as the weekly water levels of Asa Dam were used as input parameters for the development of the flow rate model. The flow rate model is then simulated in MATLAB environment to establish the linear relationship between the power and the falling height of the dam. The result of the model shows that the theoretical power varies linearly as the falling height of water in the dam while maintaining a constant flow rate of about 50m^3/s.*

Key words: *Flow Rate, Retrofitting, Dams, Hydroelectric Generation, Water Turbine Generators, Theoretical Power, Penstock, Falling Height.*

Language: *English*

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1.0 Introduction

Hydro-electric power plants convert the kinetic energy contained in falling water into electricity [[21], [22], [26], [27], [31]]. The energy in flowing water is ultimately derived from the sun and is therefore constantly being renewed. Energy contained in sunlight evaporates water from the ocean and deposits it on land in form of rain. Differences in land elevation result in rainfall runoff and allow some of the original solar energy to be captured as hydro-electric power [[28], [29], [30], [32]].

Most hydroelectric power comes from the potential energy of dammed water driving a water turbine and generator. In this case, the energy extracted from the water depends on the volume and on the difference in height between the source and the water's outflow. This height difference is called the head 'h'. The amount of potential energy in water is proportional to the head. To obtain very high head, water for a hydraulic turbine may be run through a large pipe called a penstock [[5], [9], [12], [16], [25]].

1.1 Advantages of hydropower

Hydropower has the following advantages over other forms of energy production in terms of economics, social and environmental impacts [[1], [3], [2], [7], [8], [20], [23]]:

i. Hydropower is a form of clean renewable and sustainable energy as it makes use of the energy in water due to flow and available head without actually consuming the water itself. Unlike the burning of coal, oil and natural gas, it does not emit any atmospheric pollutants such as carbon dioxide, sulphur oxides, nitrous oxides or particulates such as ash.

ii. Hydropower schemes often have very long lifetimes and high efficiency levels. Operating costs per annum can be as low as 1% of the initial investment costs.
iii. Hydropower schemes often have more than one purpose. Hydropower through water storage can be used for flood control and can supply water for irrigation or consumption and dams constructed for hydropower can also be used for recreational purposes. Different forms of hydropower including reservoir, pumped storage and run-of-river systems of various sizes are available and can be used for different forms of electricity generation.

1.2 Reasons for Retrofitting

Some of the reasons for retrofitting are [[4], [6], [10], [11]]:

i. New operation purpose:- Dams could play a major role as storage for electricity generated from variable renewable energies (wind, solar, etc.). Economic benefits of this purpose were not considered adequately when assessing the viability..
ii. Mitigation: As climate change has become a major issue, electricity generated from hydropower can be a means of achieving emission reduction goals.
iii. Need for power generation: As some reservoirs are prone to sedimentation and contamination due to extensive use of fertilizers upstream, energy could also directly be used for the cleaning of the dam.
iv. Change in political priorities: With respect to altered political constellations, economic development status or other factors affecting the policy priorities might have changed.

Hydro schemes can be classified according to the level of power output. A summary of scheme classification is given in Table 1 below [[13], [14], [15], [17], [18], [19]].

Table 1

Classifications of Hydro schemes

.

Classification	Range	Purpose
(i) Pico	Up to 5 kW	Small Local Generation-Simple off Grid Domicile.
(ii) Micro	5 kW to 100 kW	Small Community off Grid Generation.
(iii) Mini	100 kW to 1 MW	Community Generation-either off or On-Grid.
(iv) Small	1 MW to 10 MW	Commercial Scale Generation Feeding Grid
(v) Medium	10 MW to 100 MW	
(vi) Large	100 Mw +	

2.0 Materials and Method.

2.1 Development of Flow Rate Model

Basic Assumptions in the development of flow rate model:

i. A set amount of flow is drawn off constantly to produce a constant amount of power
ii. Peak power is produced during the peak times of the day by considering daily releases into the peak values.
iii. A variable amount of flow is drawn off up to a maximum that the turbine can handle.
iv. Water is directed from the river to the intake.
v. The flow of water is decelerated by entering a settling tank or forebay in which particles suspended in high velocity flows can come to rest. The intake and forebay are often protected by a trash rack which does not allow large floating debris to pass into the penstock and turbine.
vi. The penstock carries the water at pressure to the turbine which is situated in the power house containing generation and control equipment.
vii. The water flow then exits the power house through the tailrace and back into the main water course.

Consider Figure 1 and 2 below:

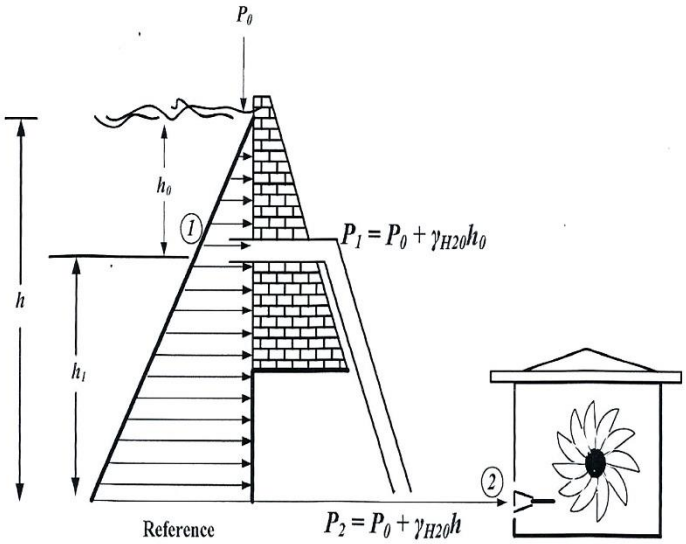

Figure 1 - Variable Pressure by water height.

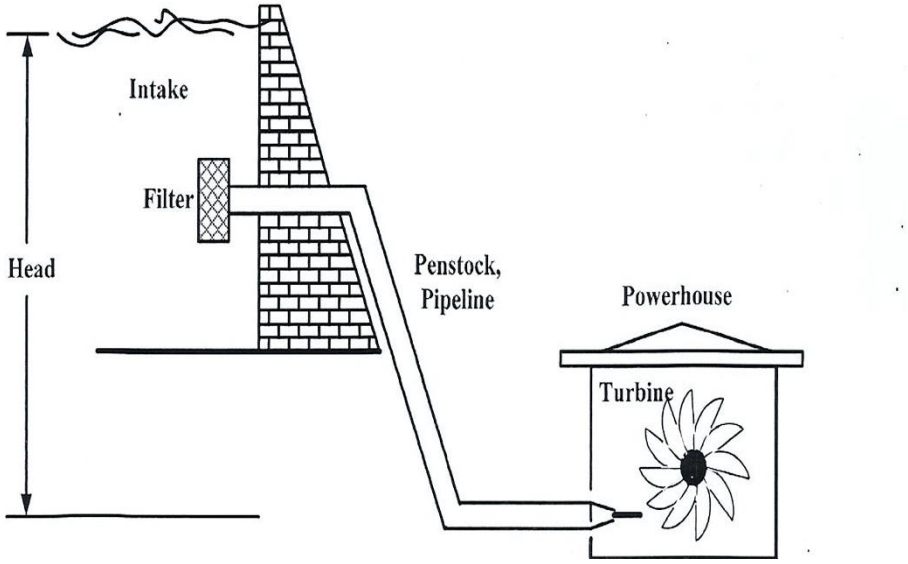

Figure 2 - Hydroelectric Power Generation.

For a volume of fluid which is not in motion or is in a state of constant motion, Newton's Laws states that it must have zero net force on it i.e. the forces going up must equal the forces going down. This force balance is called the hydrostatic balance. The net force over one point is due to the fluid weight. The linear variation of pressure by water height is given by.

$$P = P_a + \gamma h \quad (1)$$

Where γ = Specific Weight of the fluid

P_o= Atmospheric pressure

h= Height

The velocity at the intake of the system point 1 is the same as the velocity in point 2, but not necessarily the same at the turbine input. This is due to the use of nozzles at the pipe end in some cases. The continuity equation states that for steady flow in a pipeline, the weight flow rate (weight of fluid passing a given station per unit time) is the same for all locations of the pipe.

The law of conservation of energy states that energy can neither be created nor destroyed. This means that the total energy of a system remains constant. The total energy includes potential energy due to elevation and pressure and also kinetic energy due to velocity. Considering the system, the total energy is

$$E_t = WH_1 + W\frac{P_1}{\gamma} + \frac{1}{2}\frac{W}{g}v_1^2 = Constant \quad (2)$$

$$WH_1 + W\frac{P_1}{\gamma} + \frac{1}{2}\frac{W}{g}v_1^2 = WH_2 + W\frac{P_2}{\gamma} + \frac{1}{2}\frac{W}{g}v_2^2 \quad (3)$$

Where V_1, V_2 = velocities at the two points

H_1= Losses in pipe

Equation (3) is known as Bernoulli's Equation.

For a pipe in which fluid is flowing with a weight flow rate, W that has units of weight per unit time, the pipe has two different-size cross-sectional areas identified by stations 1 and 2. The continuity equation states that if no fluid is added or withdrawn from the pipeline between stations 1 and 2, then the weight flow rate at stations 1 and 2 must be equal, i.e.

$$W_1 = W_2 \quad (4)$$

$$\gamma A_1 V_1 = \gamma A_2 V_2 \quad (5)$$

The power available from falling water can be expressed as

$$P_{th} = \rho q g h \quad (6)$$

where

P_{th} = available theoretical power

ρ = density (kg/m^3) (~ 1000 kg/m^3 for water)

q = water flow (m^3/s)

g = acceleration due to gravity (9.81 ms^{-2})

h = falling height, head (m)

Efficiency

Due to energy loss, the available power will be less than the theoretically available power. The practically available power is expressed as:

$$P_a = \mu\rho q g h \quad (7)$$

where

P_a = power available (W)

μ = efficiency (in general in the range 0.75 to 0.95)

g = acceleration due to gravity (9.81 m/s^2)

h = falling height, head (m)

Energy from Hydropower

The potential theoretical energy in a volume of elevated water can be expressed as:

$$W = \rho V g h \quad (8)$$

Where

W = energy (J)

V = volume of water (m^3)

g = acceleration due to gravity (9.81 m/s^2)

h = falling height, head (m)

Capacity Factor

Capacitor factor (CF) is the ratio of actual output to its potential output over a period of time.

$$C.F = \frac{\left(Energy\ Generated\ per\ year\ \left(\frac{kWh}{year}\right)\right)}{(Installed\ Capacity\ kW)\times 8760^{hour}/_{year}} \quad (10)$$

Potential energy of water

$$P.E = M \times g \times H \quad (11)$$

Kinetic energy of water

$$K.E = {}^{1}/_{2} \times M \times C^2 \quad (12)$$

where:

g is the acceleration due to gravity (9.81 m/s²),

H is the Effective Pressure Head of water across the turbine (m).

C is the jet velocity of water at the intake of the turbine blade (m/s).

and:

$$\text{jet velocity} C = \sqrt{2gH}, \quad (13)$$

The weekly water level reading of Asa Dam collated over a period of thirty-six weeks were used. The discharge over the dam can be calculated from:

$$Q = 1.8(L - 0.2h)h^{1.5} \quad (14)$$

where Q is the discharge in m^3/h.

L is the length of the water in 'm'.

H is the height of the level of water flowing over the veir.

The amount of water flow rate is expressed as:

$$F.R = \frac{\pi}{4}d^2\sqrt{2gZ} \quad (15)$$

Where: Z is the specific head height in meters, d is distance between dams.

Simulation

The weekly water level readings of the dam over a period of thirty six weeks were used as simulation parameters for the development of the flow rate model for Asa Dam using MATLAB codes.

3.0 Results and Discussions

The measured water level in the dam within the thirty six weeks study period is illustrated in Figure 1. Figure 2 shows the variation of the time and the date for the dam for the study period.

On April 15, 2016, the measured water level was 1.1 cm at 15.20 hours of the day while the measured water level at 14.10 hours on April 22, 2016 was 1.8 cm. The monthly flow rate of the dam in April 2016 was 1.511 m^3/s with a percentage flow rate of 5%. The percentage flow rate varied inversely as the monthly flow rate throughout the month of April 2016. The least and highest percentage flow rate of 5% and 95% gave corresponding flow rates of 1.511 m^3/s and 0.29 m^3/s respectively as illustrated in Figure 3.

The measured water level fluctuates between 2.1 cm and 2.6 cm in the month of May 2016. In this month, the least water level of 2.0 cm was measured on the dam on May 16, 2016 at exactly 15.05 hours of the day while the highest water level of 2.6 cm was measured on the dam on May 21, 2016 at 14.34 hours of that day. Figure 4 shows the relationship between the percentage flow rate and the monthly flow rate for May 2016. In this year, a least

percentage flow rate of 5% gave a monthly flow rate of 1.236 m^3/s while the highest percentage flow rate of 99% gave a monthly flow rate of 0.09 m^3/s indicating an inverse relationship between the time parameters.

In the month of June, 2016, the measured water level of the dam fluctuated between 2.1 cm on June 17, 2016 at 14.13 hours of the day to 2.9 cm on June 21, 2016 at exactly 14.23 hours of the day. This is because appreciable level of rainfall was recorded and experienced during this month of June, 2016. In June 2016, a percentage flow rate of 25% gave a monthly flow rate of 1.21 m^3/s with an inverse correlation between the two parameters as shown in Figure 5.

On July 6, 2016, 2.8 cm was recorded as the measured water level of the dam during the 12.35 hours of the day. The water level fluctuated throughout this month between 2.7 cm and 3.2 cm on July 10, 2016 and July 21, 2016 during the 13.43 hours and 14.37 hours of those days respectively. This is because more rainfalls were experienced during this month as well. Figure 6 shows the flow rate for the month of July, 2016. In this month, a percentage flow rate of 75% corresponds to a flow rate of 0.16m^3/s even though, the percentage flow rate increases as the monthly flow rate decreases.

The least measured water level of 2.9 cm was recorded on August 13, 2016 during the 15.39 hours of the day while the highest water level of 10.3 cm was measured on August 24, 2016 during the 17.25 hours of the day. This is because this month of August marked a month of continuous rainfall during the year. The rainfalls experienced during this month lasted for a longer period of time and it was consistent. The percentage flow rates of 20%, 30% and 40% gave corresponding monthly flow rates of 1.91 m^3/s, 1.74 m^3/s and 1.51 m^3/s respectively for August, 2016 thus showing an inverse relationship between the two parameters as shown in Figure 7.

The month of September 2016 witnessed or experienced a reduction in level of rainfall compared to the previous months . On September 3, 2016, the measured water level of the dam was 2.4 cm. the least measured water level was 1.7 cm on September 12, 2016 during the 15.27 hours of the day while the 15.23 hours of September 29, 2016 witnessed the highest measured water level of 6.8 cm even though, the measured water levels fluctuated throughout this month. Figure 8 illustrates the flow rate for September 2016. The percentage flow rate and the monthly flow rates are inversely related as seen in Figure 8.

October 2016 witnessed a prolonged shortage of rainfall because the least measured water level of the dam was 1.1 cm on October 27, 2016 during the 20..33 hours of the day while the highest measured water level of 4.2 cm was recorded on October 4, 2016 during the 18.26 hours of the day.. The correlation between the percentage flow rate and the monthly flow rate for the month of October 2016 is shown in Figure 9.

The measured water levels in the dam during the month of November reduced appreciably probably because this month marked an acute shortage of rainfall. The least water level measured on the dam was 0.7 cm on November 5, 2016 during the 16.36 hours of the day while the highest measured water level of the dam was 1.3 cm on November 9, 2016 during the 17.20 hours of that day simply because this month marked a period of regular rainfall. Figure 10 illustrates the relationship between the percentage flow rate and the monthly flow rate for the month of November 2016. In this month, the least monthly flow rate of 1.43 m^3/s was recorded while the highest monthly flow rate of 0.87 m^3/s was recorded with percentage flow rate of 5% and 99% respectively. An inverse correspondence exists between the two parameters as well.

Figure 11 shows the total monthly flow rate for the dam. The percentage flow rates also vary inversely as the total monthly flow rate for the dam for the study period. The least total monthly flow rate is 4.06 m^3/s which corresponds to a highest percentage flow rate of 99%.

Figure 12 shows the variation of the power with the falling heights. The height undergoes variations as the flow rate remains approximately constant. The falling height of the water dam was 2m at a theoretical power of 100W. The power in this case varies linearly as the falling height. Thus, at a power of 600W, the falling height was 12m. Figure 13 shows variation of the flow rate with the falling height of the water dam. The flow rate varies inversely as the height of the falling water.. A linear flow rate model of the form $y = 0.3014x + 0.1032$ was developed for retrofitting of dam for hydroelectric power generation.

$$y = 0.3014x + 0.1032$$

$$p = qh + c$$

Where:

y = flow rate model

x = falling height of water in the dam

The model will read the input parameters and calculate the flow rate of the system.

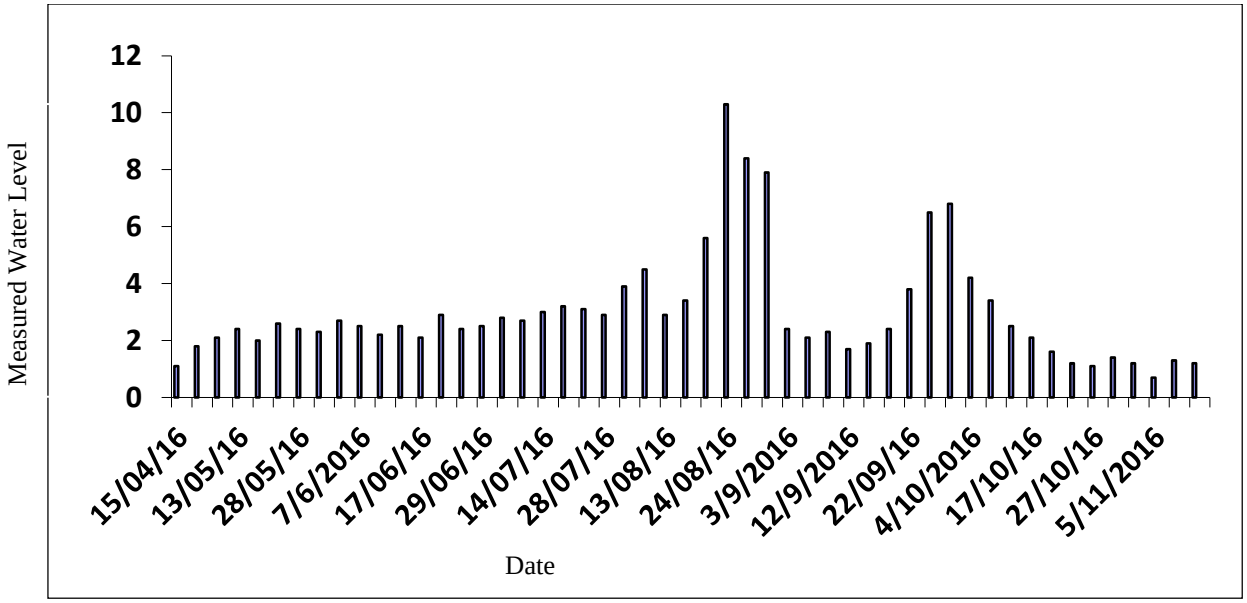

Figure 1 - Measured Water Level versus Date.

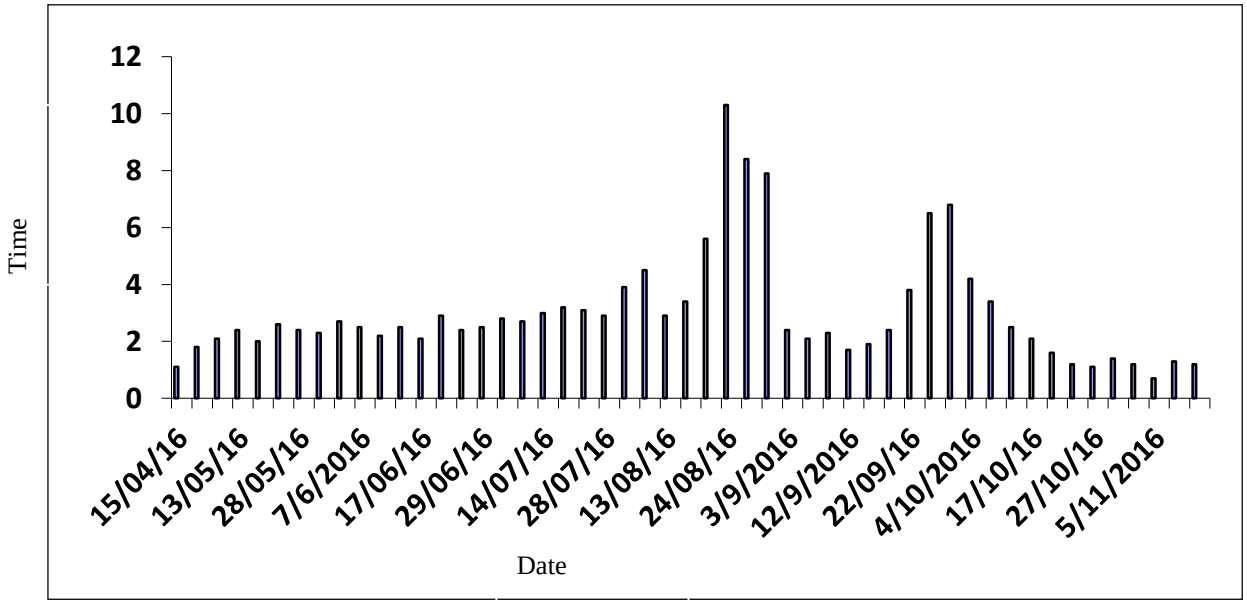

Figure 2 - Time versus Date.

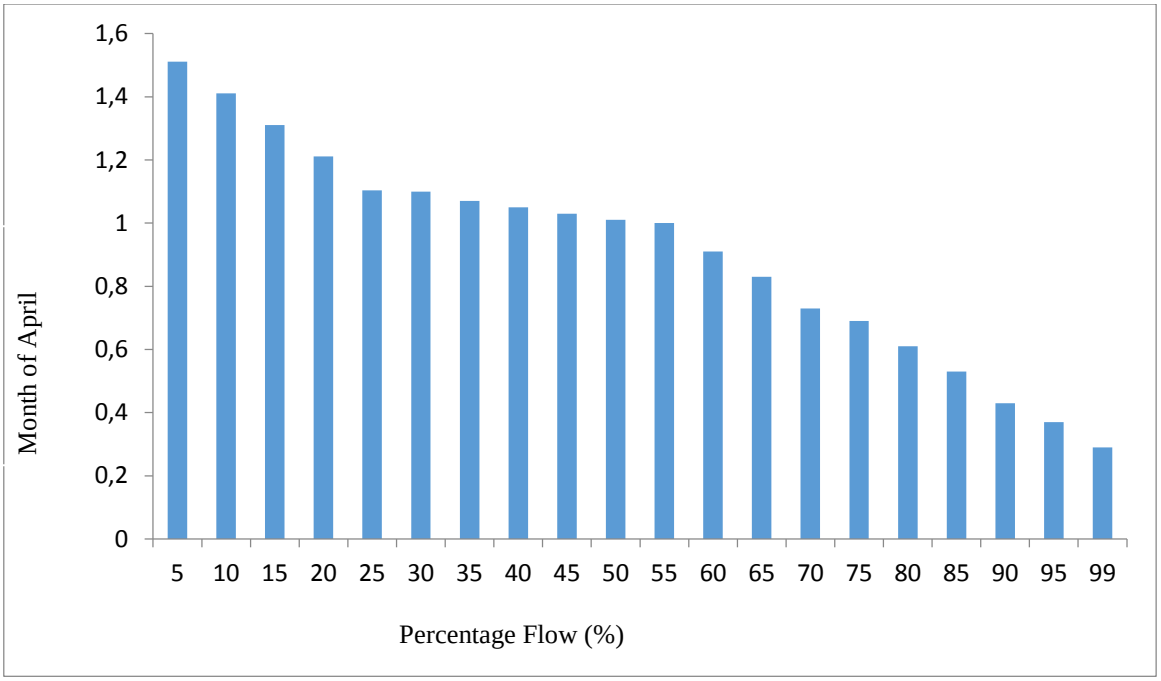

Figure 3 - Flow rate for April.

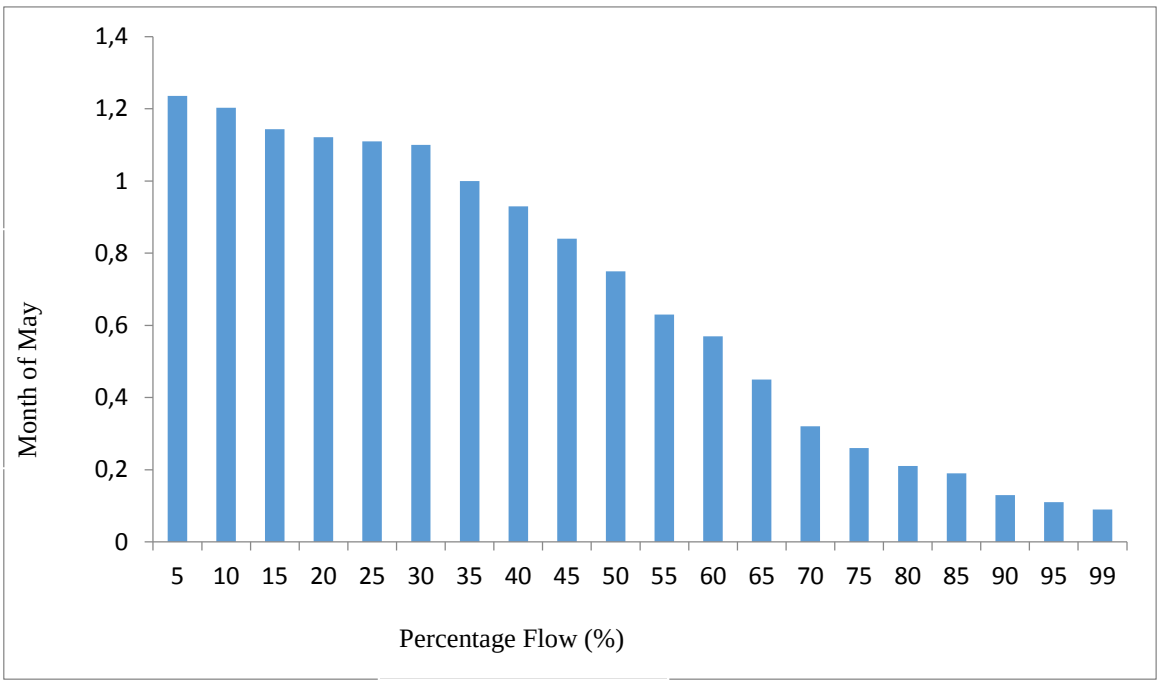

Figure 4 - Flow rate for May.

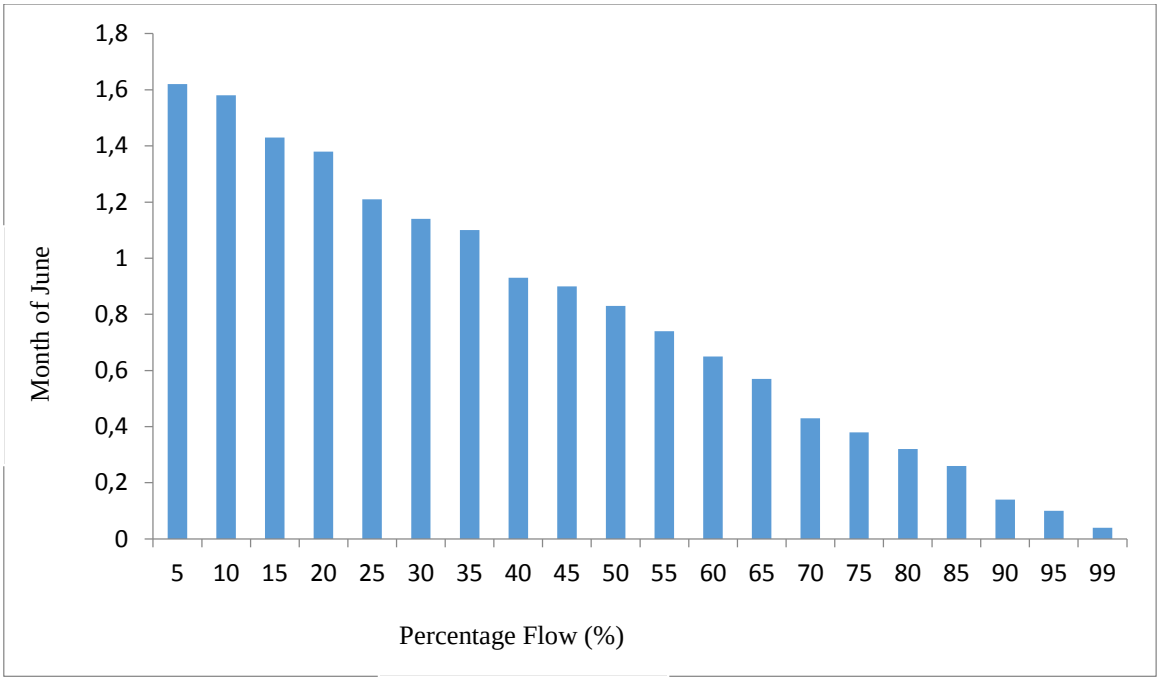

Figure 5 - Flow rate for June.

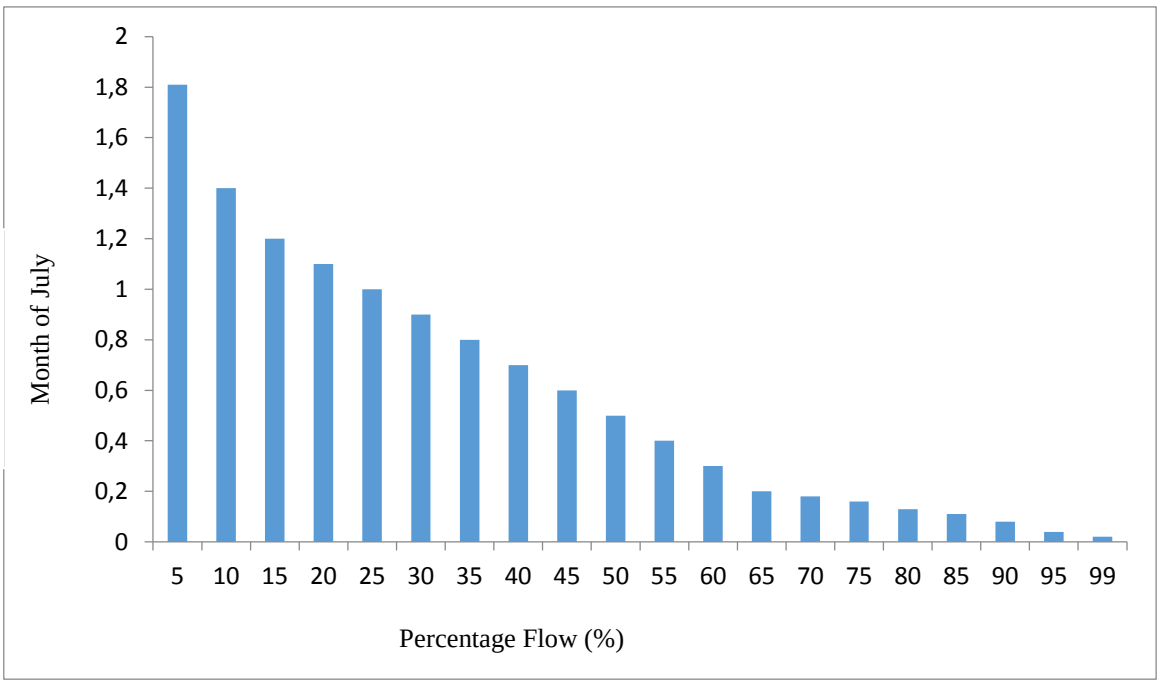

Figure 6 - Flow rate for July.

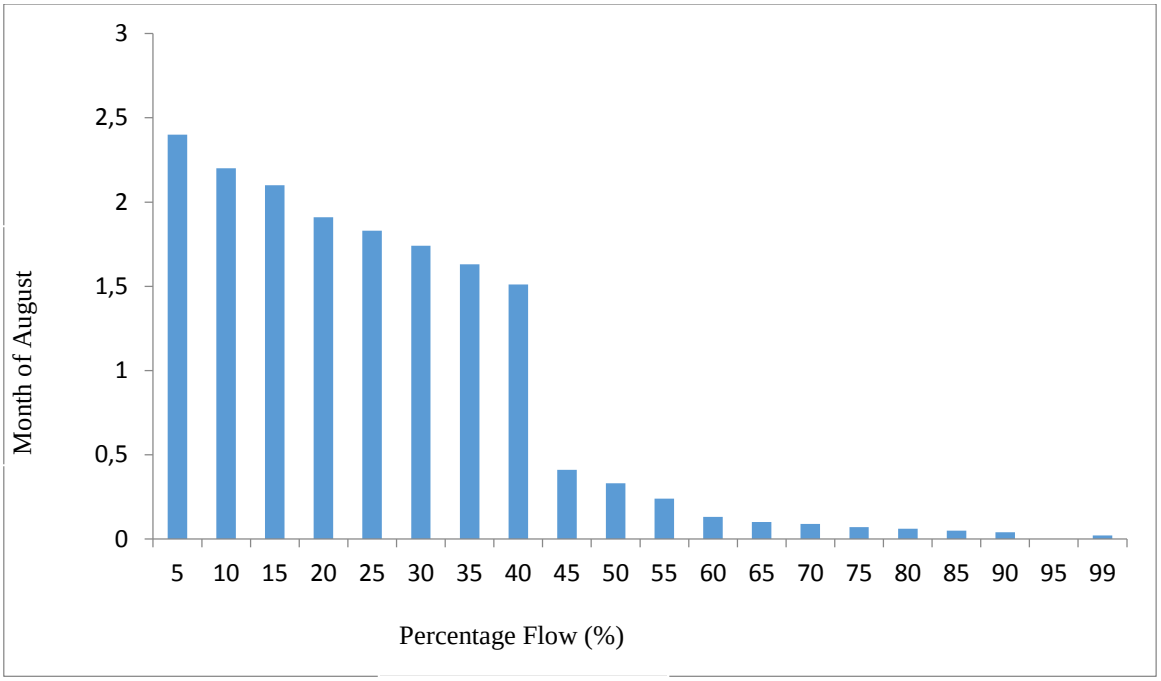

Figure 7 - Flow rate for August.

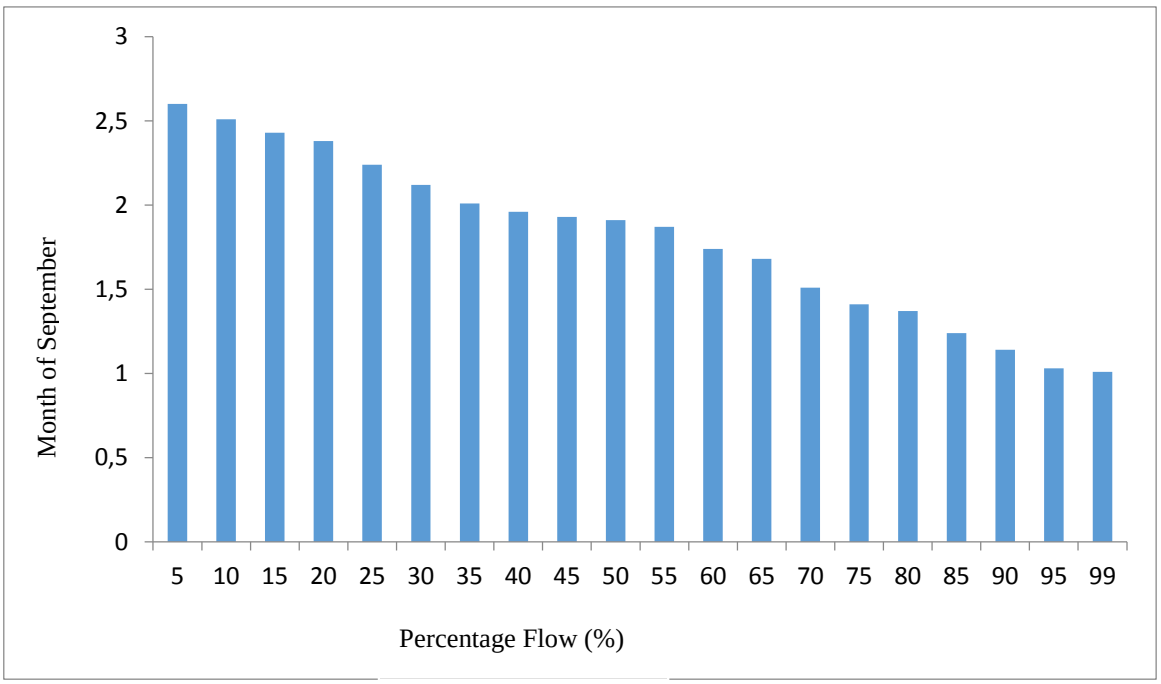

Figure 8 - Flow rate for September.

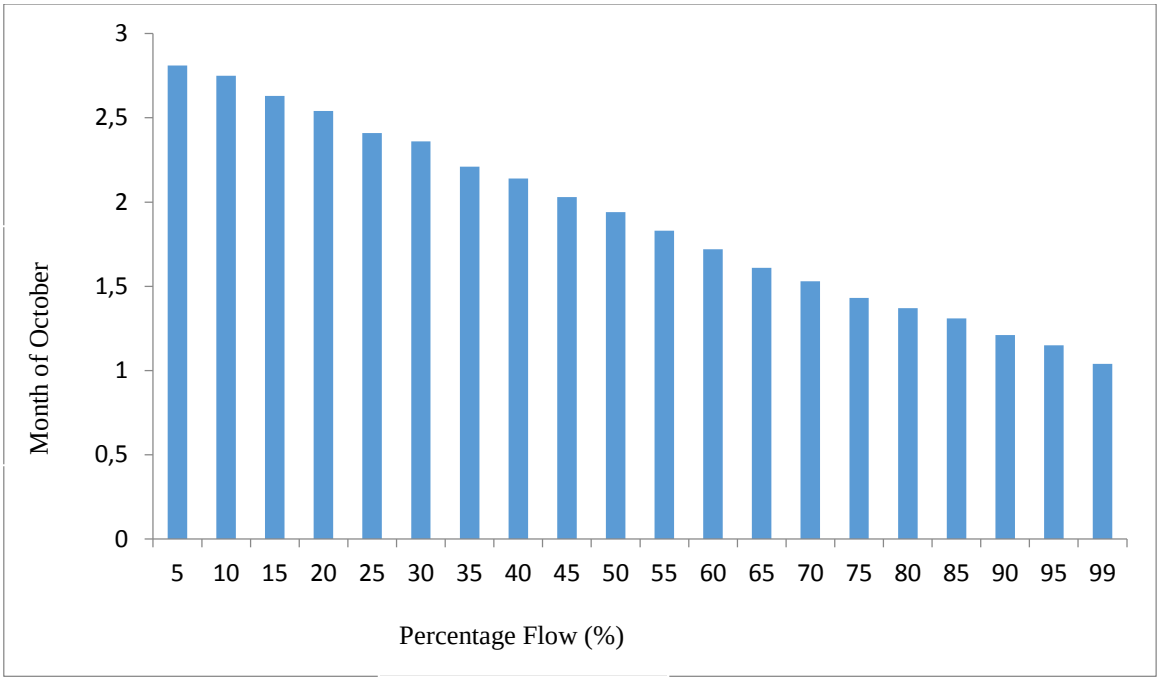

Figure 9 - Flow rate for October.

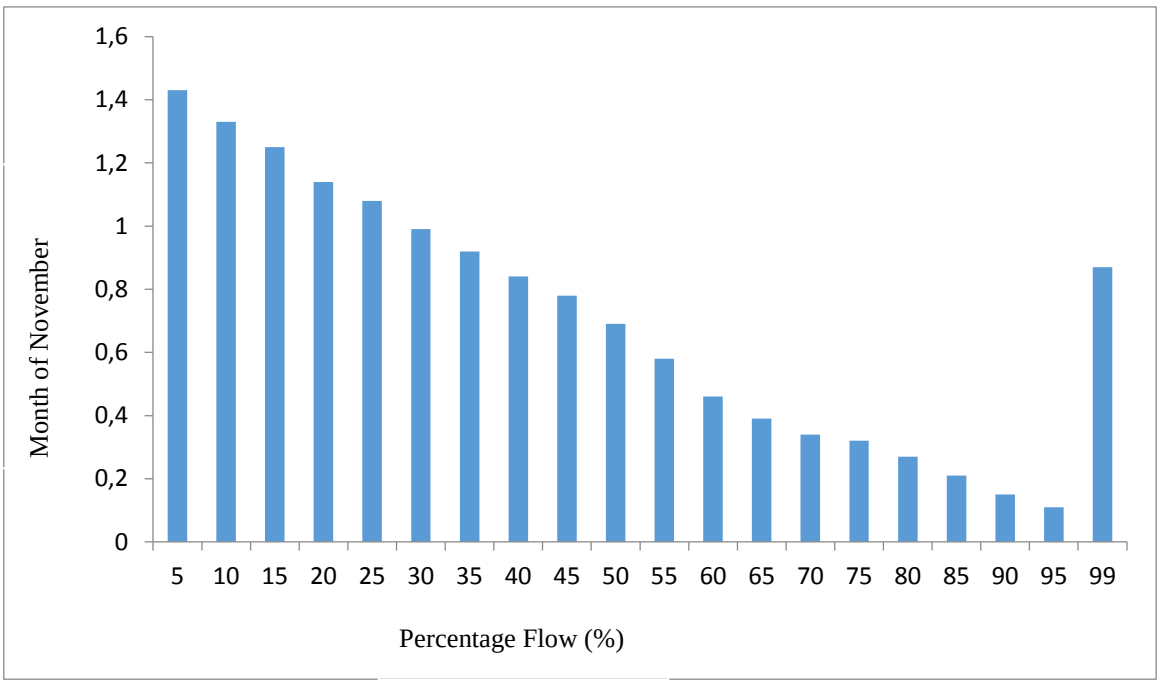

Figure 10 - Flow rate for November.

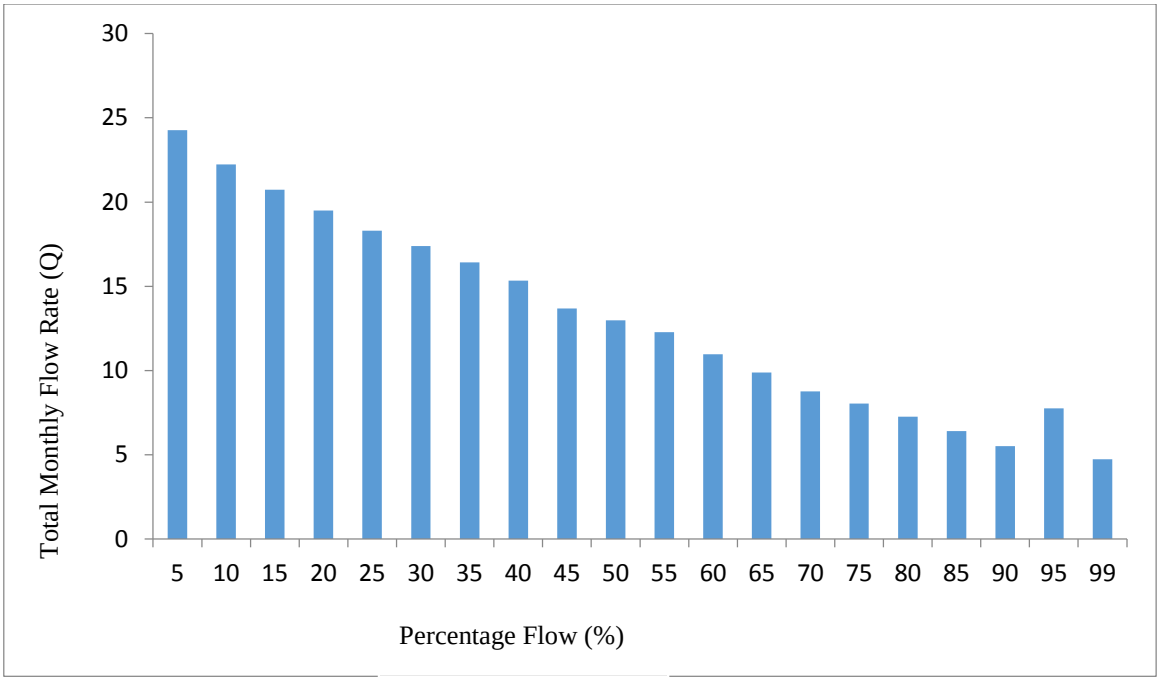

Figure 11 - Total Monthly Flow Rate.

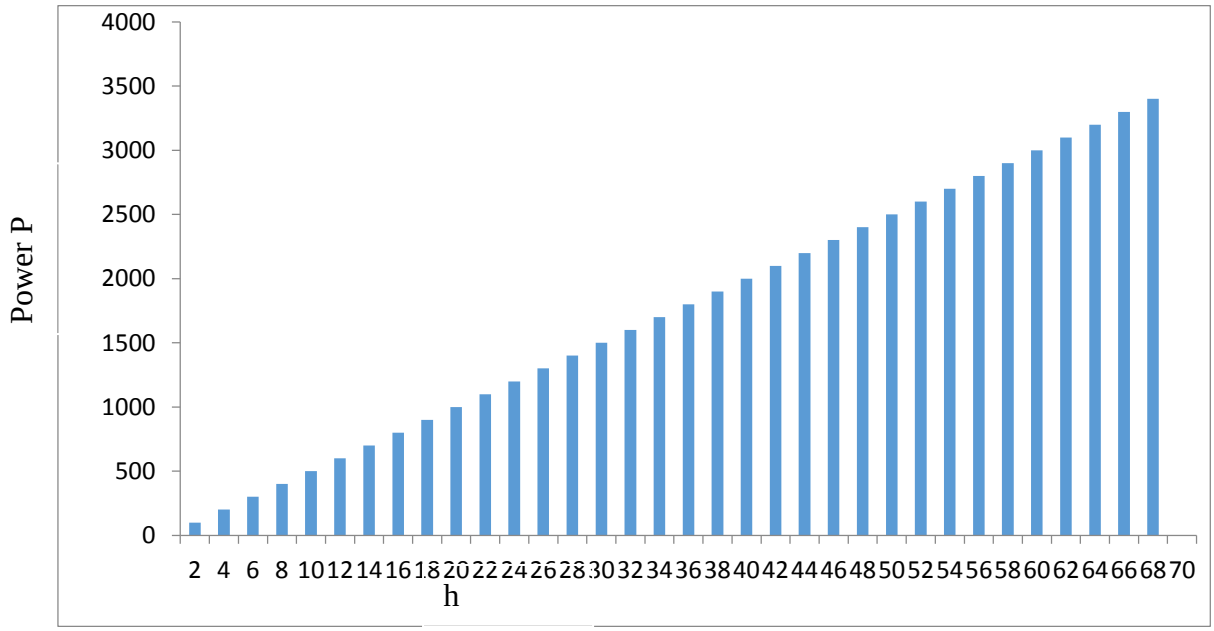

Figure 12 - Variation of the power with the falling height h.

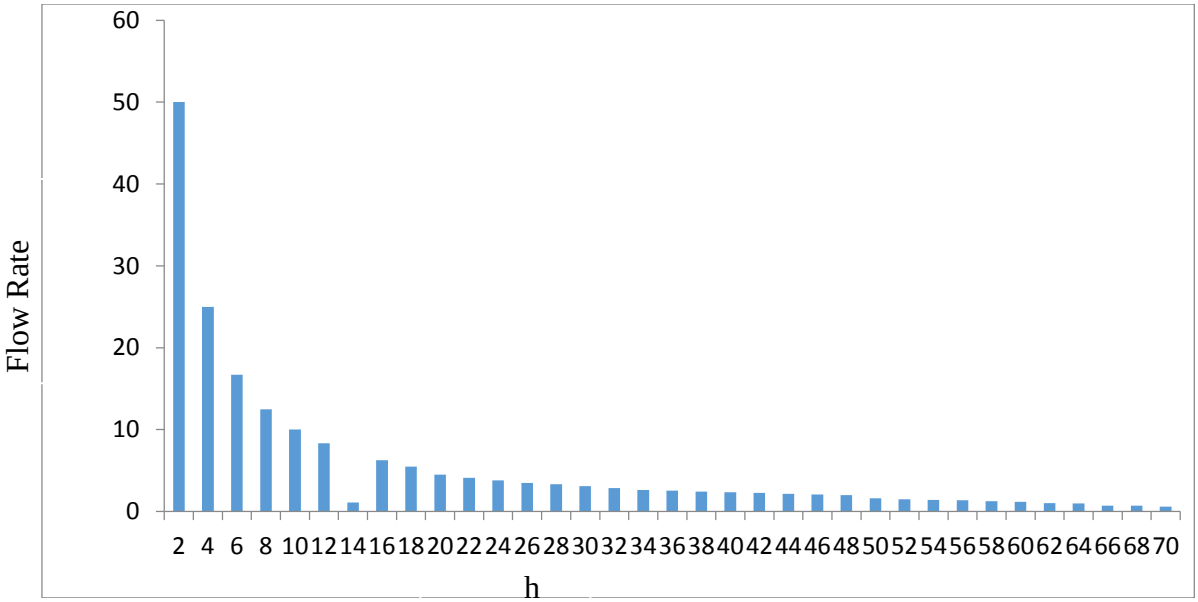

Figure 13 - Variation of flow rate with the falling height h.

4.0 Conclusion

A linear flow rate model for retrofitting of dam for hydroelectric power generation has been developed.

The model development started with the use of power available from falling water as input parameter with simulation carried out and coded in MATLAB.

The measured water level fluctuates throughout the study periods, the percentage flow rate of the dam increases as the monthly flow rate decreases.

The result of the linear model shows that there exist a linear correspondence between the theoretical power and the falling height of water in the dam while the flow rate was held constant at about $50m^3/s$.

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SECTION 6. Metallurgy and energy.

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ANALYSIS OF THE MANUFACTURING PROCESS OF THE CASE-SHAPED CASTING IN THE SAND MOULD

Abstract: *In the article there are considered the manufacturing stages of the casting of frame of the terminal box in the conditions of JSC «Vladimir electromotive plant». On the basis of the performed computer simulation of the casting process of the casting in the sand mould there were obtained the three-dimensional fields of cooling, the flow velocities and the Niyama criterion for gray cast iron. The time of cooling (solidification) of the alloy in the sand mould was determined. In accordance with the basic technological process of casting in the sand mould, the comparison of the admissible value of volumetric shrinkage of the casting material with the calculated value was performed.*

Key words: *a casting, melt, a model, time, temperature, filling, solidification, shrinkage, a sand mould.*

Language: *English*

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Introduction

Today JSC «Vladimir electromotive plant» (Russia) carries out the manufacturing of accessories and the assembly of the low voltage electric motors by power from 0.75 to 315 kW [1]. The main products of the enterprise are the three-phase asynchronous motors for the general industrial use. The motors of the special modification (explosion-proof, single-phase, for the drive elevators, for the electric hoists and etc.) are produced also.

In addition to mechanical and assembly shops in the structure of JSC «Vladimir electromotive plant» includes the foundry shop and a number of the auxiliary productions which constitute LLS «Lit-VEMP». The nomenclature of LLC «Lit-VEMP» is 400 castings of gray cast iron GG10 (DIN), EN-GJL-150 (EN), EN-GJL-200 (EN), CGI35 (ISO), CIB2 and aluminium ENAC-44200 (EN), G-AlSi10Mg (DIN) for the different modification of the electric motors. The dimensions accuracy and the geometry correctness of the castings are ensured by means of

the designing of the gated pattern in the computer program Pro/Engineer.

Grey iron has good casting properties. At high castability and low shrinkage of the material, it is possible to perform precision casting of the thin-walled castings. However, casting in the production conditions maybe accompanied by the dimensions change and (hidden) defects in the casting structure. This occurs during the deviation from the technological process of casting (particularly the massive iron casting). The poor quality casting will have mechanical, operational and other properties which don't correspond by the technical requirements. The risk of the partial fracture of the part/casting material (in depending purpose and operation mode of the assembly unit) is increased.

The computer simulation, which is as close as possible to the real technological process of casting, will allow to determine the possible defects in the casting structure and to perform corrective actions for their elimination.

Materials and methods

The technological process of casting of frame of the terminal box of the electric motor in the sand mould [2] is simulated.

The case-shaped part is intended for protection of the terminal box of the electric motor from ingress of dust and chip during the operation. The part «Frame of the terminal box» is the part of the three-phase asynchronous motor with the squirrel-cage rotor (series 5AMN). The electric motor of this series is modernized and protected with the height of the rotation axis of 315 mm. The configuration and the dimensions of the part «Frame of the terminal box 5AMN 315» are presented in Fig. 1 – 6.

The technical requirements for the manufacturing of the part «Frame of the terminal box 5AMN 315»:

1. Accuracy of the casting 9-0-9-6 GOST 26645-85 [3].
2. Limit deviations 3.2 10 cl. GOST 26645-85.
3. The casting must comply by the factory standard 520011.014-99.
4. The pattern tapers by GOST 3212-92 [4] in the direction of increasing of the body casting.
5. Not specified foundry radii up to 3 mm.
6. Coating of the casting in accordance with a climatic design.
7. * The dimensions for reference.

The main technological data for the implementation of the casting process are presented in the map of the technological information [5] (table 1). The basic technological process of the manufacturing casting with indication of the special equipment and the piece time on the performing of the each operation is presented in table 2.

On the drilling machine the processing of ten through-holes by a diameter of 8 mm and four through-holes by a diameter of 12 mm is done.

The operation of chipping and finishing consists of six technological steps.

Chipping of the (gates) feeders is occurred on the first step. The cross sectional area of the (gates) feeders is 5.6 cm^2.

On the second step, chipping of the flashes at the parting line of the sand mould is exercised. A length of the flash up to 1500 mm at a thickness of 2 mm.

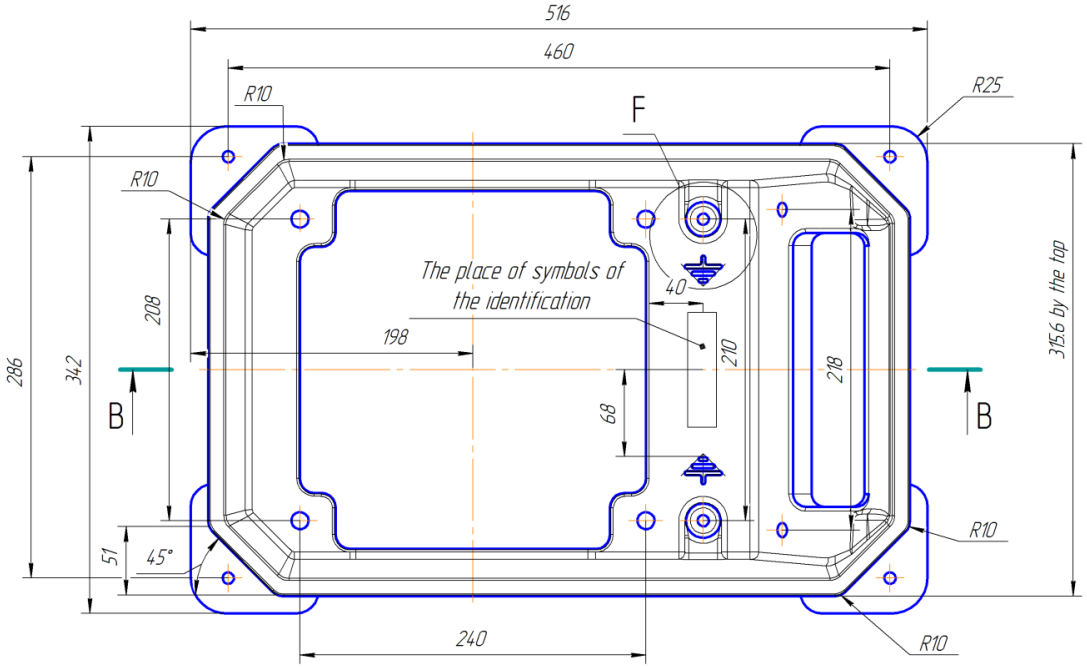


Figure 1 – The drawing of the part «Frame of the terminal box 5AMN 315». Top view.

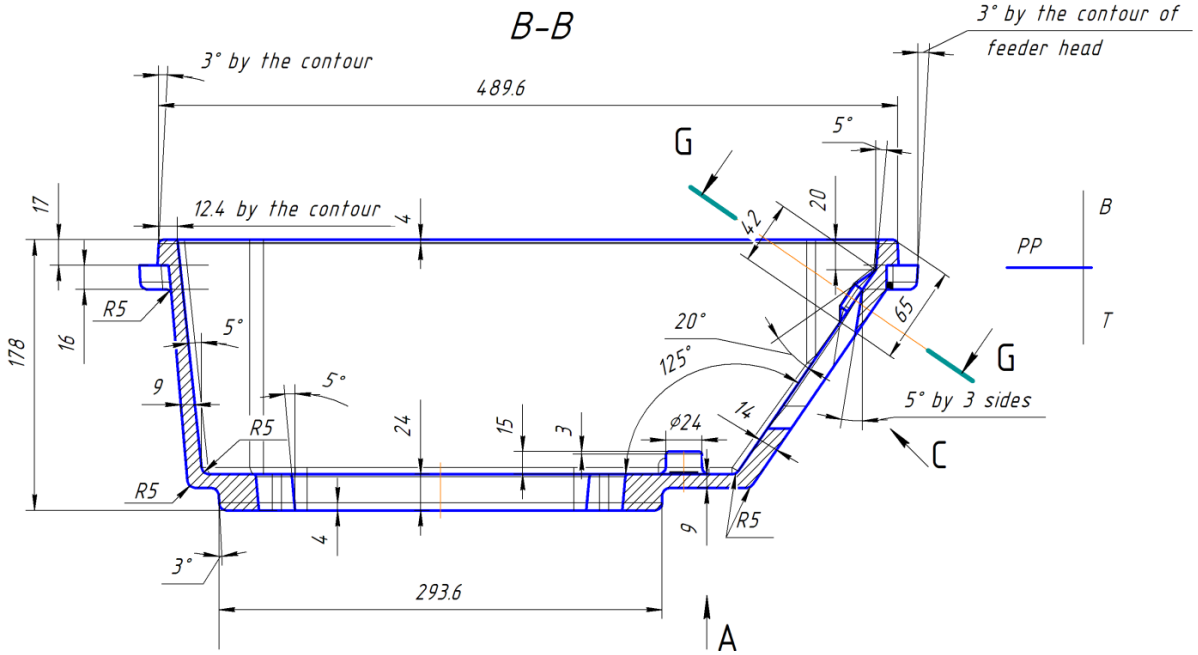


Figure 2 – The drawing of the part «Frame of the terminal box 5AMN 315». Longitudinal section B-B.

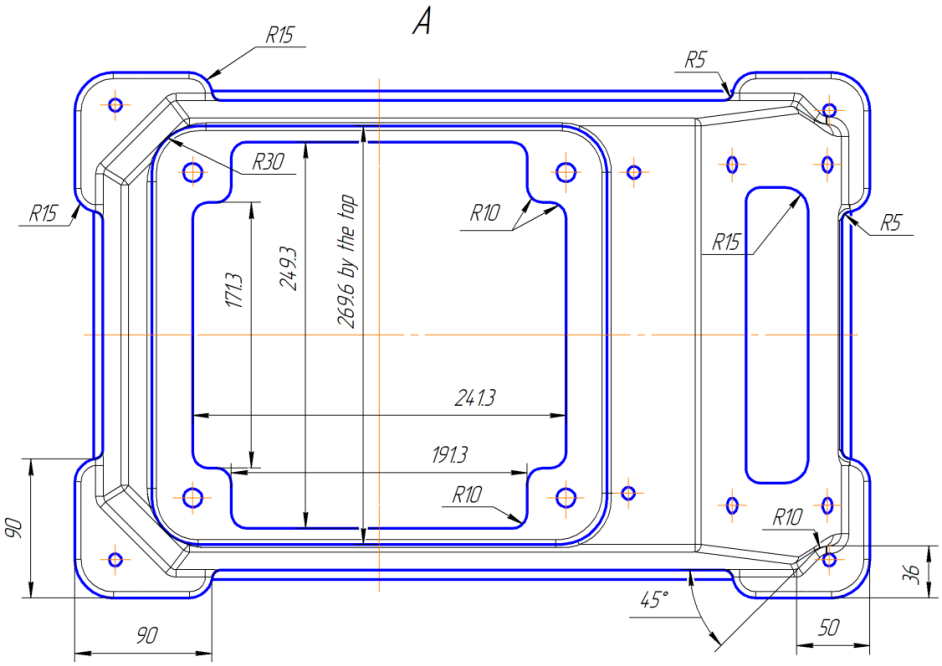


Figure 3 – The drawing of the part «Frame of the terminal box 5AMN 315». View A.

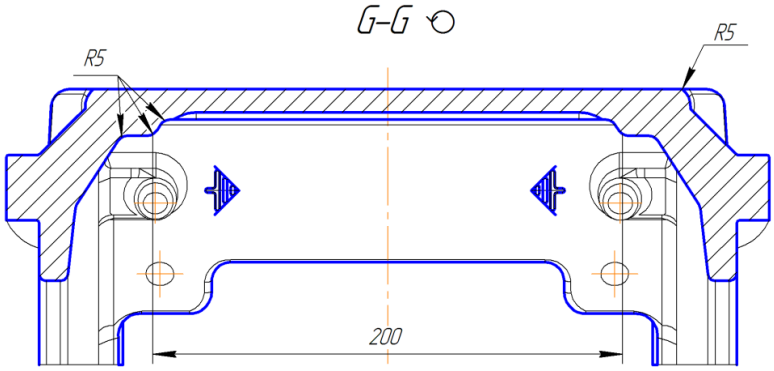


Figure 4 – The drawing of the part «Frame of the terminal box 5AMN 315». Cross section G-G (rotated).

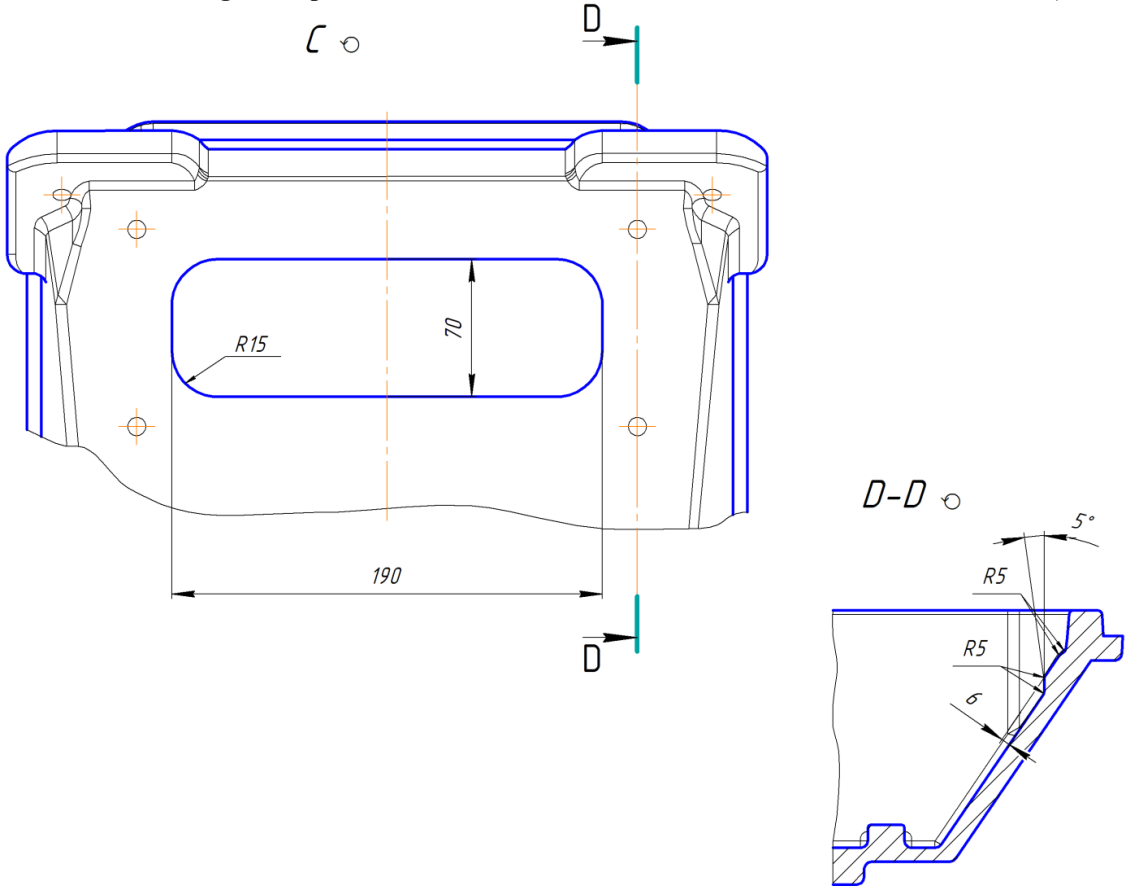


Figure 5 – The drawing of the part «Frame of the terminal box 5AMN 315». View C (rotated), longitudinal section D-D (rotated).

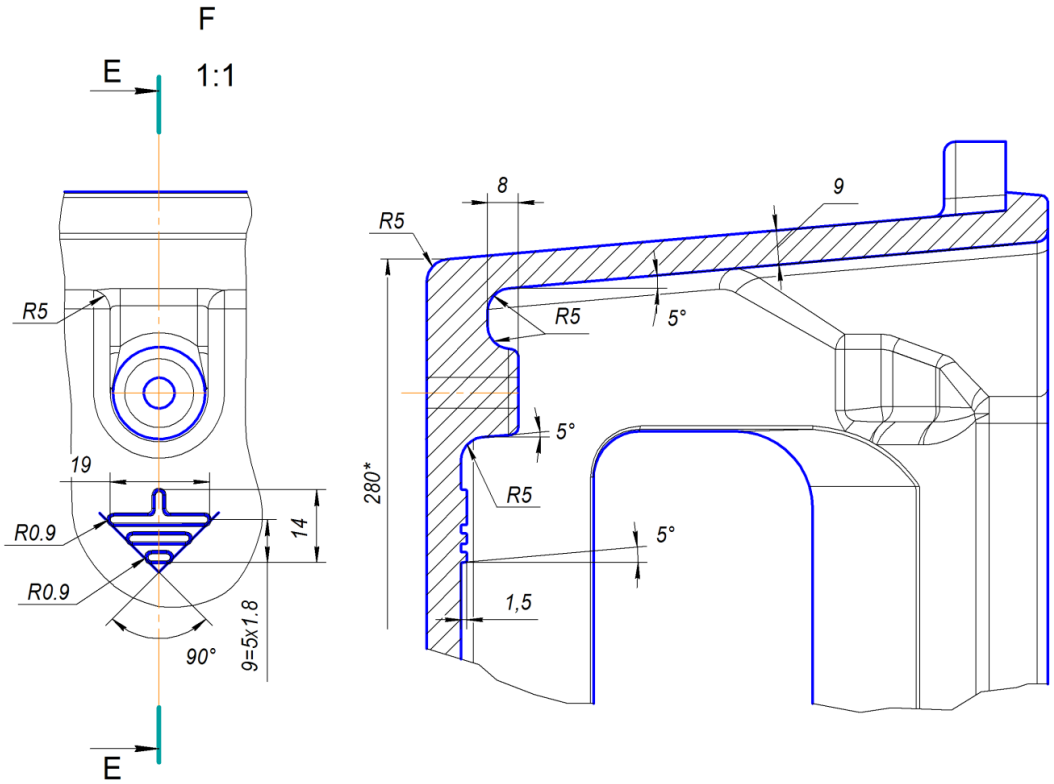


Figure 6 – The drawing of the part «Frame of the terminal box 5AMN 315». Removal element F, cross section E-E.

Table 1

The technological information of the casting process.

Number of the complexity criterion according to the price list №25-01	1…10
The complexity group of the casting on the basis of the complexity criterion	1-3, 2-1, 3-1, 4-5, 5-2, 6-1, 7-1, 8-3, 9-3, 10-4
Adopted by the complexity group of the casting	2
The complexity group by assignment, responsibility and requirements	3
The accuracy class of cast iron and steel castings according to GOST 26645, or other classifiers for non-ferrous casting	9
The unit of rationing, which is set the consumption rate of the material	1
Shrinkage	1 %
The quantity of castings in the mould	1
A length of the flask in the light	650 mm
A width of the flask in the light	540 mm
A height of the flask in the light	350 mm
Mass	110 kg
Mass of moulding sand	370 kg
The type of the sand mould	Sand-and-clay
The melting unit	Cupola, Q = 5 t/hr
The temperature of metal during filling of the mould	1320 – 1330 °C
The bucket capacity	500 kg
The exposure time of the casting in the mould	24 min

Table 2

The technological process of the manufacturing casting by casting in the sand mould.

Operation	Operation name	Equipment	Piece time, min
010	Preparation of charge material	Gantry crane (2 pieces)	0.4
020	Charge drawing and bulk charging	Beam crane (1 piece); Weighing cart; Tipping bucket	1.447
030	Melting of metal	Cupola, Q = 5 t/hr (1 piece)	0.483
040	Preparation of moulding materials	Rotary drier (1 piece); Clay mixer (1 piece)	0.4122
050	Preparation of moulding sand	Mixers (2 pieces)	2.8855
060	Moulding	Moulding machine (2 pieces)	2.69
070	Material handling on pouring and knock-out of the moulds	Floor conveyor (1 piece)	
080	Pouring	Mechanical hanger (1 piece); Ladle	0.957
090	Release of the flasks		0.2061
100	Knock-out of the castings	Mechanical eccentric vibrating grid (1 piece); Jib crane; Sledgehammer; Hook	1.253
110	Reweighting of the castings from the overhead conveyor-3 to the overhead conveyor shot-blasting chamber	Overhead electric hoist, capacity – 250 kg (1 piece); Hook; Hook for shot-blasting chamber	0.244
120	Finishing of the castings from the ground and burn on, reweighting them on the overhead conveyor-5	Shot-blasting chamber (1 piece); Overhead electric hoist, capacity – 250 kg (1 piece); Hook	0.58
130	Removal of the castings from the overhead conveyor-5	Overhead electric hoist, capacity – 250 kg (1 piece); Hook	0.244
140	Chipping and finishing	Tool-and-cutter grinding machine (1 piece); Pneumatic grinder; Forging chipper; Sledgehammer	
150	The inspection of the castings		
160	Hanging of casting on the conveyor of priming chamber	Overhead electric hoist, capacity – 250 kg (1 piece); Hook; Hanger	0.206
170	Priming of casting	Priming chamber (1 piece); Hanger	0.206
180	Removal of casting from the priming conveyor	Overhead electric hoist, capacity – 250 kg (1 piece); Hook	0.206
190	The inspection of casting after priming		
200	Transporting of casting in the machine shop	Beam crane, capacity – 2.0 t (1 piece); Battery-driven truck; Bank	0.489
Total time:			12.9088

On the third step, chipping of metal penetration and sand fusion, scabs, surface contaminations, knobs as needed on internal and external surfaces of the casting is performed. The chipping area up to 600 cm^2.

On the fourth step, finishing of the traces of the feeders is produced. The cross sectional area of the (gates) feeders is 5.6 cm^2. As a cutting tool the grinding wheel 1. 600×80×306 14A F22 N 7 V 35 m/s 1 cl. A GOST 2424-83 [6] is used.

On the fifth step, chipping of the flash at the parting line of the sand mould is performed. A length of the flash up to 1500 mm at a thickness of 0.5 – 2 mm.

On the sixth step, finishing of metal penetration and sand fusion, scabs and knobs in places where available by sharpening of the grinder is performed. The finishing area up to 600 cm^2. As a cutting tool the grinding wheel 1. 150×10×32 14A F40 N 7 B 40 m/s 1 cl. A GOST 2424-83 is used.

The inspection operation is performed after casting and priming of the casting. The inspection is subjected the appearance of the casting for the detection of blowholes, cracks and other defects. The inspection is subjected the dimensions of the casting according to the drawing and the sketch of the casting. The inspection is 2 %. The inspection is subjected the mechanical properties, chemical composition and the structure of an alloy. The appearance of the casting (the inspection is 100 %) is inspected after priming visually.

The gated pattern consists of the model plates top and bottom. The elements of the gating system are:

- the pouring basin and the sprue, which are used for reception of the stream and supply of melt at the height of the sand mould respectively;
- the dirt trap, located in the cope and used for capture of the various inclusions in melt;
- four (gates) feeders, used for supply melt directly in the mould cavity.

The configuration of the sand mould and dimensions of the elements of the gating system are presented in Fig. 7.

The three-dimensional solid model of the casting (without elements of the gating system) was created through the tools of the computer program KOMPAS-3D (Fig. 8 – 9).

The percentage of the chemical elements in the alloy EN-GJL-150 is presented in table 3. The percentage of the chemical elements in the table was determined for the alloy in the liquid state.

Thermophysical conditions of the casting process of grey cast iron in the sand mould are presented in table 4.

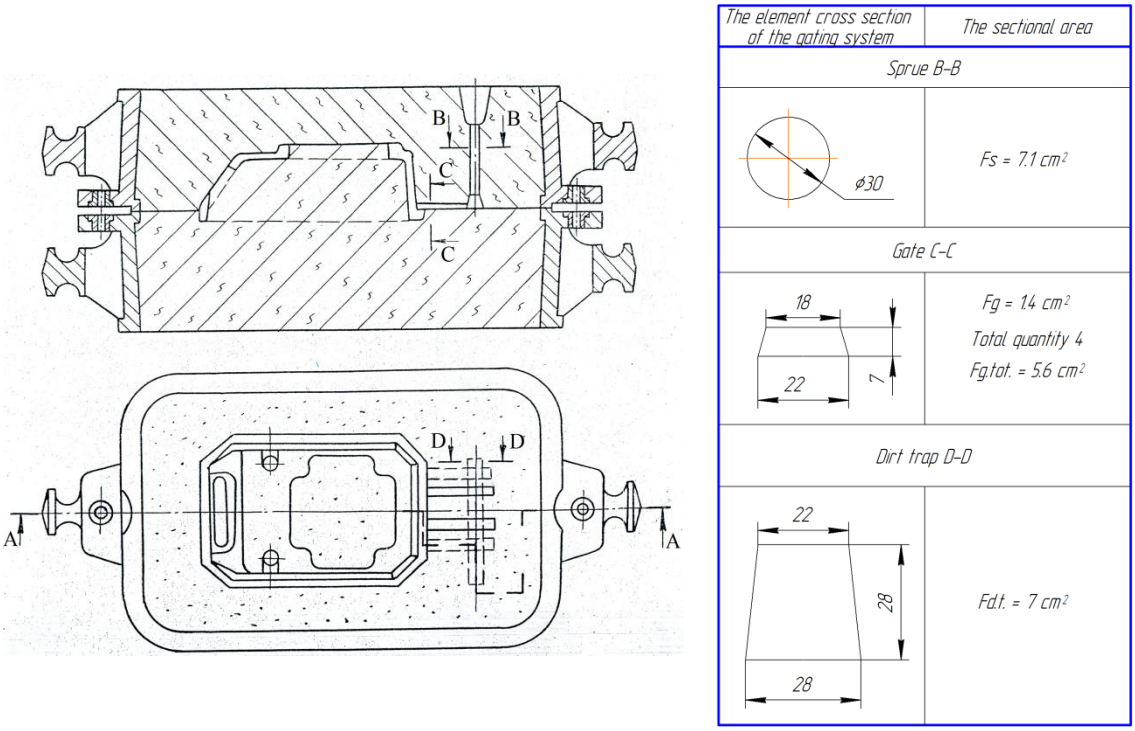


Figure 7 – The configuration of the sand mould and dimensions of the elements of the gating system.

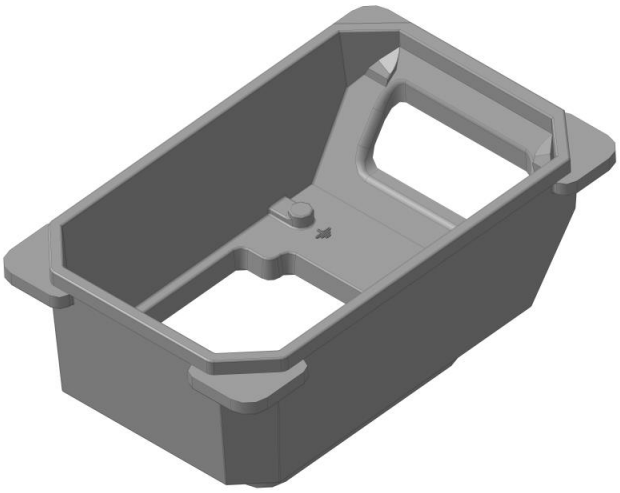


Figure 8 – The solid model of the casting (top view).

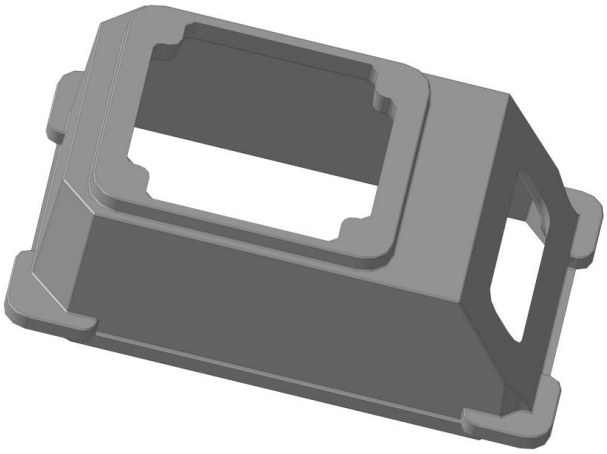


Figure 9 – The solid model of the casting (bottom view).

Table 3

The chemical composition of the alloy EN-GJL-150 in percentage.

Fe	C	Si	Mn	Cr	P	S	Ni
92.85	3.6	2.2	0.7	0.15	0.2	0.15	0.15

Phase transformations during cooling of melt are accompanied by the change of heat of crystallization, grain growth and nucleation/growth ratio.

Table 4

Thermophysical conditions of the casting process of grey cast iron.

Liquid alloy	Austenite	Cementite	Graphite
Heat of crystallization of the primary phase, kJ/kg	Heat of crystallization, kJ/kg		
160	130	330	5900
CLF up, %	Growth coefficient, mm/°C × s		
70	0.2	0.1	0.001
CLF down, %	Nucleation/growth ratio		
30	0.1	0.01	0.001
Total emissivity			
0.1	0.11	0.1	0.53

CLF up in percentage is the fraction of the liquid phase of the alloy. Free flow of melt is occurred up to 70 %.

CLF down in percentage is the critical fraction of the liquid phase of the alloy. Risering by melt between two liquid zones is impossible up to 30 %.

On the basis of the chemical composition of the alloy class and the basic constitution diagram «iron – carbon» is built the modified constitution diagram «iron – carbon» [7]. According to the modified constitution diagram there are calculated the liquidus temperature and the solidus temperature, the parameters of phase equilibria, which are determined the phase transitions during the crystallization simulation of the alloy.

The temperature ranges for the liquid alloy, austenite, cementite and graphite during cooling of grey cast iron are presented on the modified constitution diagram «iron – carbon» (Fig. 10).

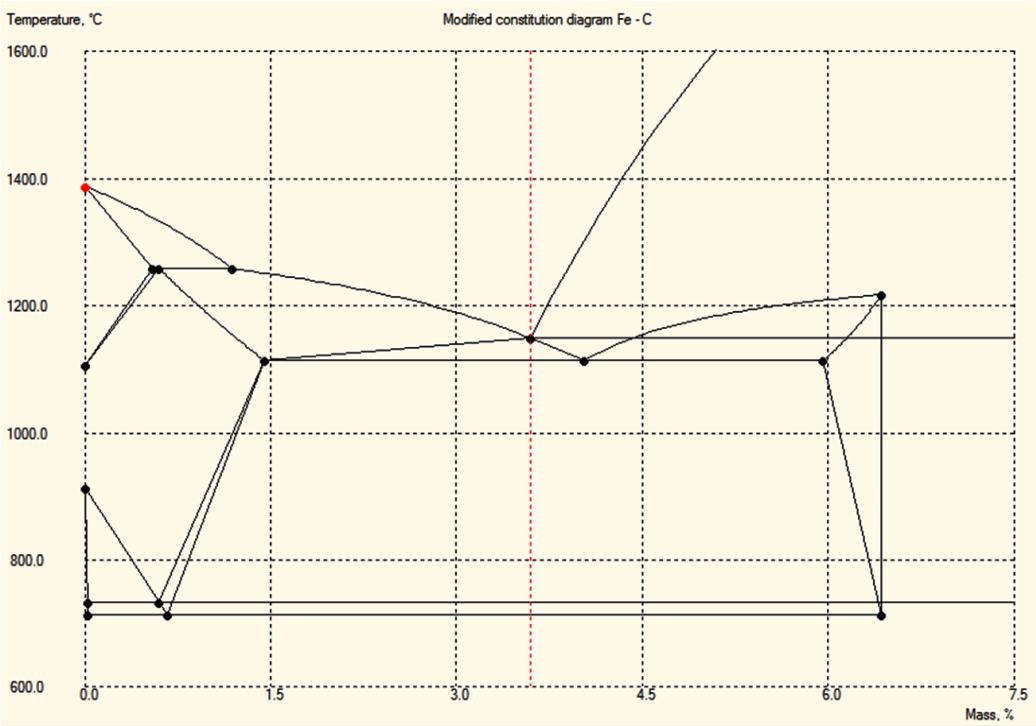


Figure 10 – The modified constitution diagram «iron – carbon».

The red dotted vertical line on the diagram is the concentration of the second main element of the alloy. In accordance with the modified constitution diagram «iron – carbon», gray cast iron is in the liquid state in the temperature range from 1150 to 1600 °C. In the temperature range from 1150 to 1113 °C it is formed graphite eutectic. The saturation of austenite by carbon is occurred in the temperature range from 1150 to 732 °C. Below of the temperature of 732 °C carbon is dissolved and graphite begins to reject from ferrite.

The values of density, heat conduction, specific heat and viscosity of gray cast iron were obtained by extrapolation. The blue dotted vertical line on the charts is the solidus temperature of the alloy, the green dotted vertical line is the temperature of the estimated kinetic solidus of the alloy. Properties change of grey cast iron during the temperature change is presented in Fig. 11 – 14.

With decreasing of the temperature, density of the alloy increases slightly. The least density occurs in the graphite phase of the alloy, the highest is in the cementite phase.

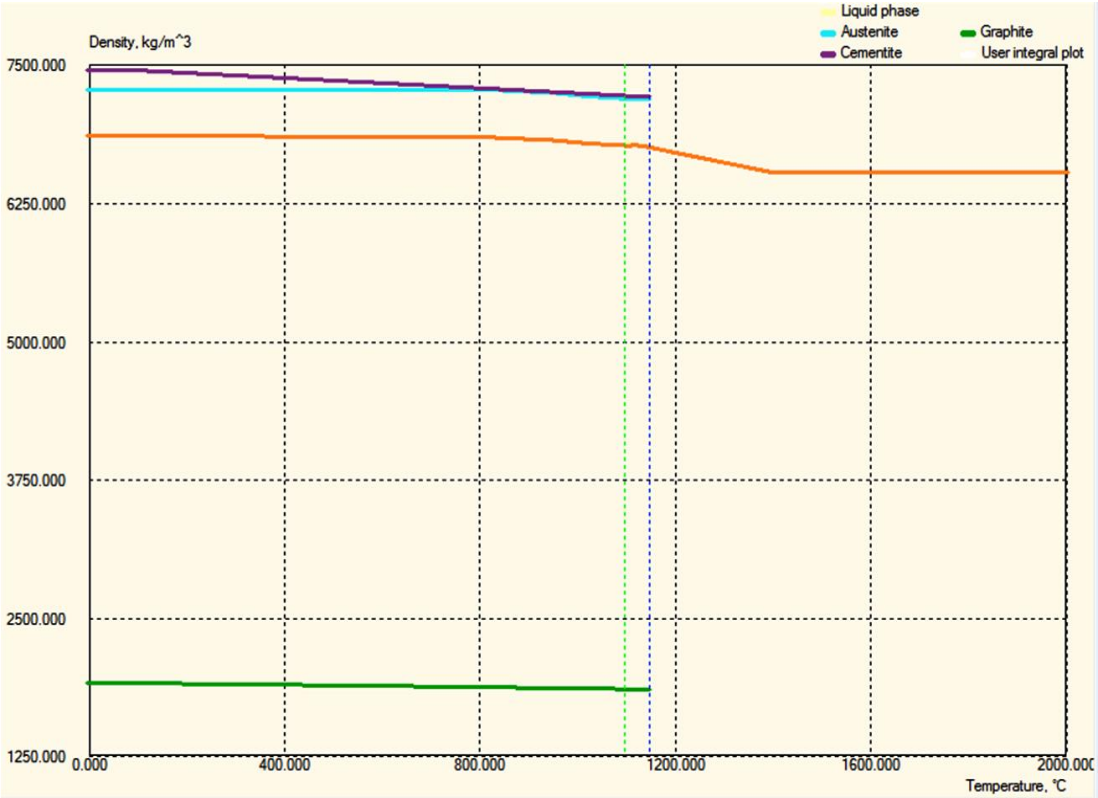


Figure 11 – Density during the change of the structural-phase state of gray cast iron.

In grey cast iron at the temperatures close to the equilibrium eutectic is observed preshrinkage expansion, for this reason the dependencies of density from the temperature for melt and for the solid phase must be formed so that density of melt near eutectic was higher than density of the solid phase.

Density calibration of the alloy was performed at setting of the following parameters: CEL (carbon equivalent) is 4.25 %, volume change of the casting material from the solidus temperature (1137.49 °C) till the ambient temperature (20 °C) is 1.12 %, the mould hardness (+GF+) is 80, liquid shrinkage is 0.65 $\frac{\%}{100°C}$, T_P is 1600 °C (ATAS is a modular process control system for analyzing, optimizing and stabilizing the foundry process), T_{Elow} is 1147.49 °C (ATAS), GRF 2 is 25, eutectic graphite is 6.5 g, proeutectic is 20 %, eutectic 1 is 50 %, eutectic 2 is 30 %, primary austenite is 15 %.

The highest heat conduction has gray cast iron saturated by graphite. Cooling of the alloy from 1200 °C to 22 °C with formation of the graphite phase is characterized by increase of heat conduction in three times. The value of heat conduction in the cementite phase doesn't change and amounts about 20 W/m × °C.

Simultaneously with increase of heat conduction in the graphite phase of the alloy, specific heat is decreased. In the cementite phase of grey cast iron, cooling occurs with constant expended energy.

The change of the value of viscosity of gray cast iron occurs above the solidus temperature, i.e. the alloy is in the liquid state. The decrease of viscosity of the alloy is observed in the temperature range from 2000 to 1300 °C.

High-silica sand was used as the mould material. The dependencies of density, heat conduction and specific heat of the mould material from the temperature are presented in Fig. 15 – 17.

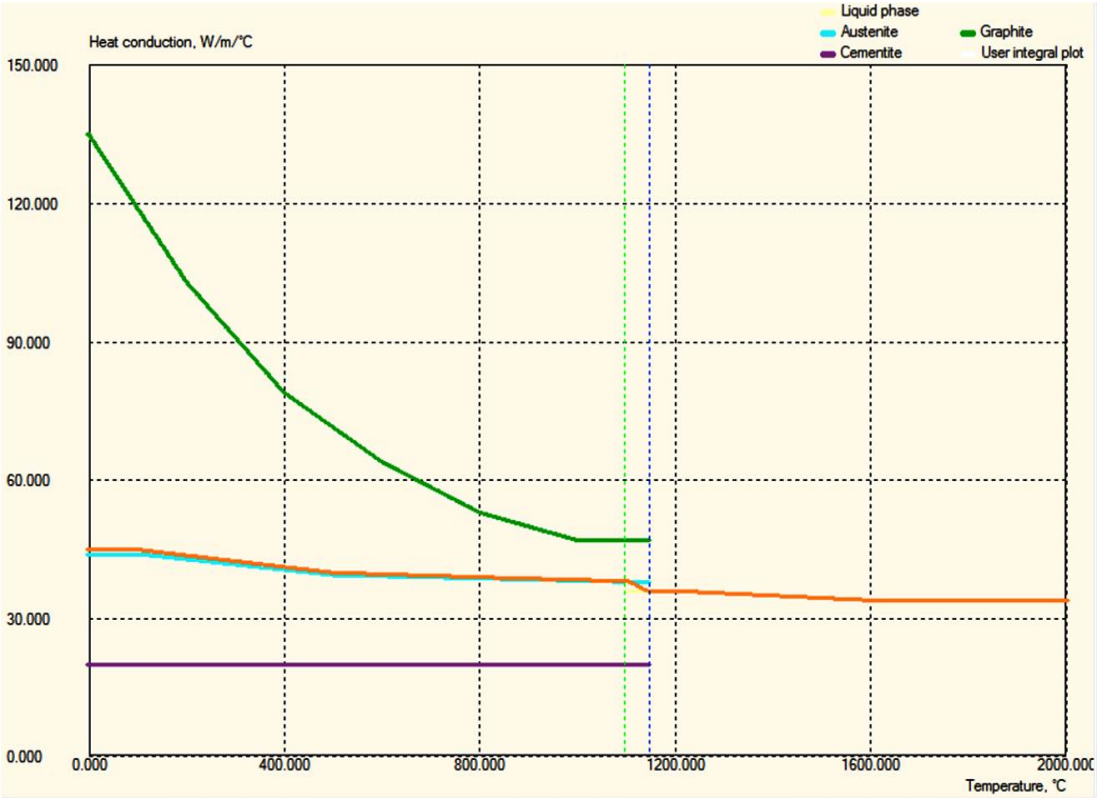


Figure 12 – Heat conduction during the change of the structural-phase state of gray cast iron.

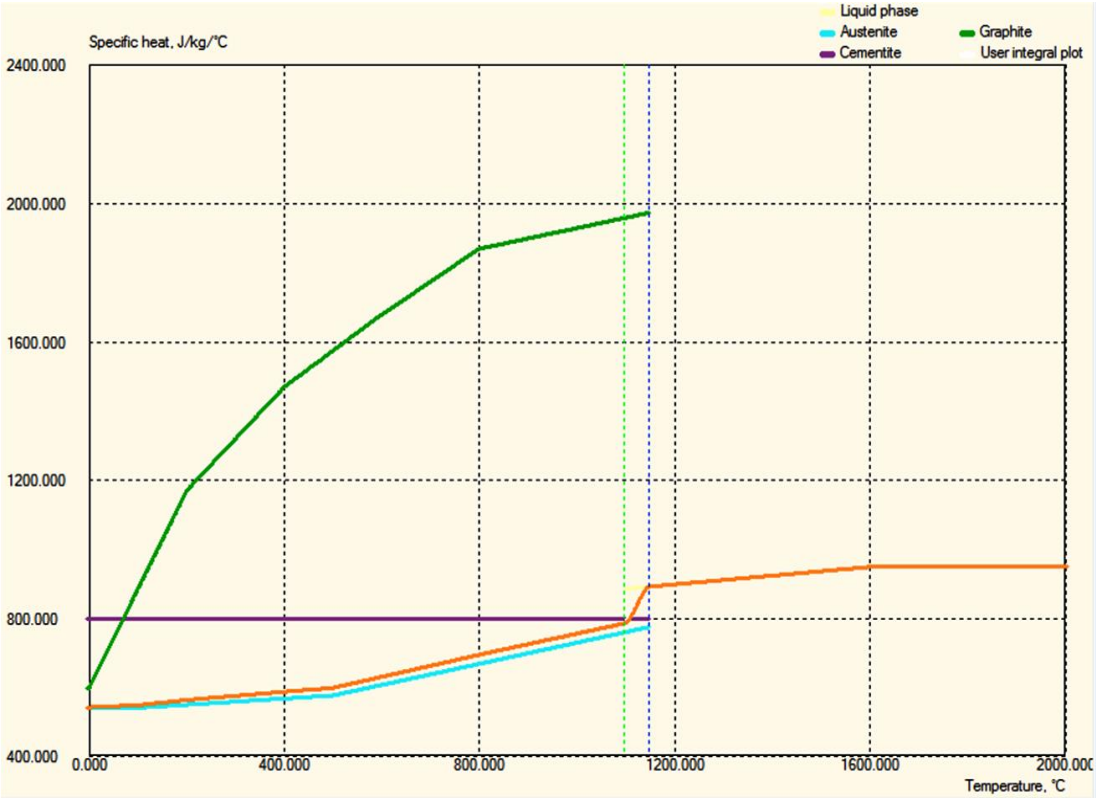


Figure 13 – Specific heat during the change of the structural-phase state of gray cast iron.

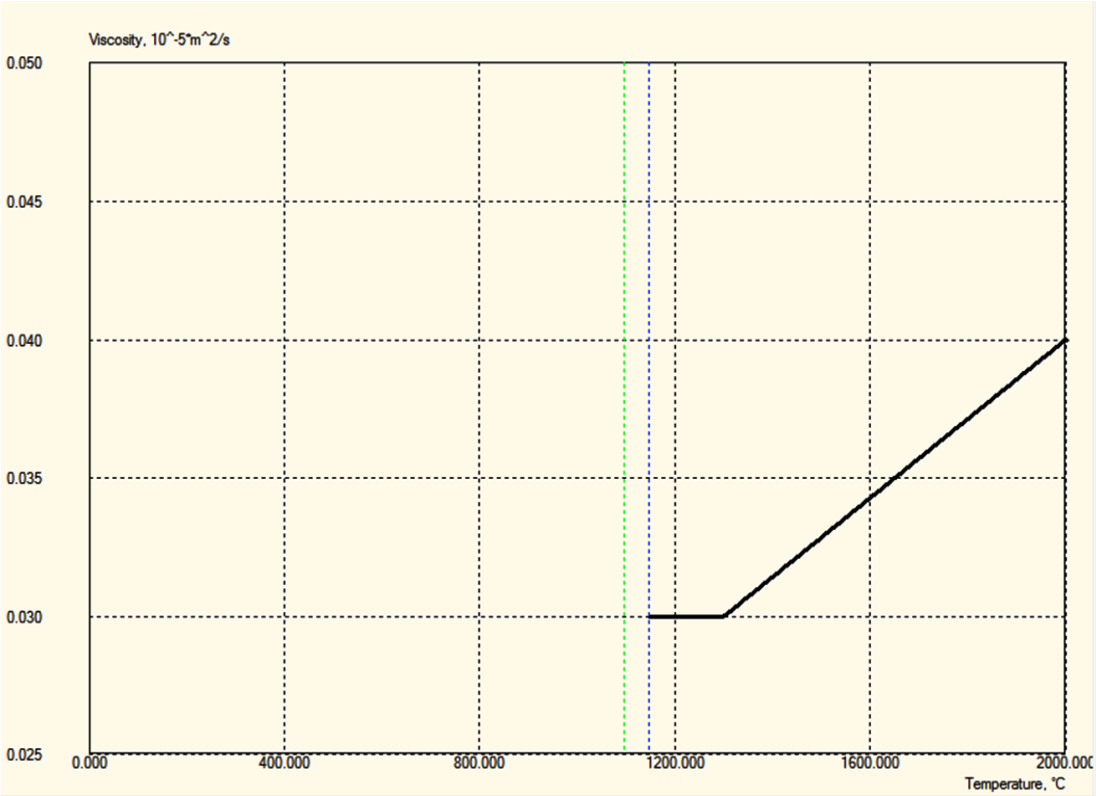


Figure 14 – Viscosity of gray cast iron during the change of the temperature.

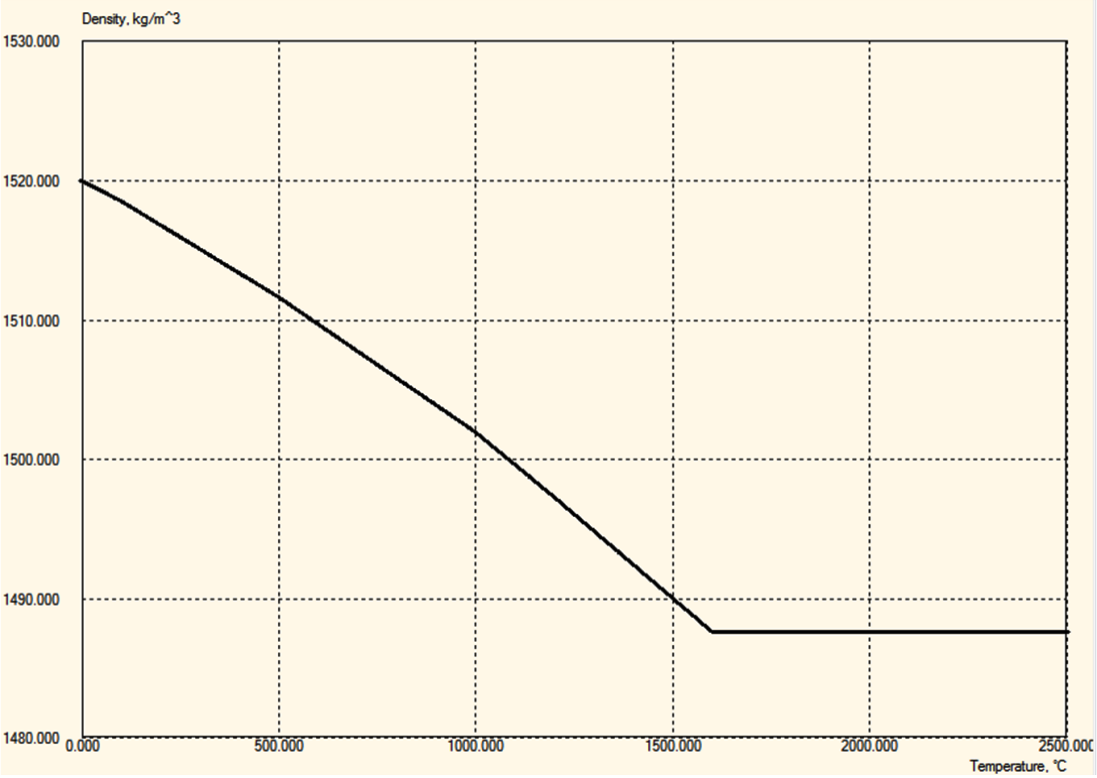


Figure 15 – The change of density of the mould material (high-silica sand) from the temperature.

Density of high-silica sand at the ambient temperature is 1519.5 kg/m^3. After filling of the mould by melt it is observed the decrease of density of the some volume of high-silica sand up to 1487.5 kg/m^3 at the temperature of 1600 °C. Change rate of density of high-silica sand in the crystallization phase is the least.

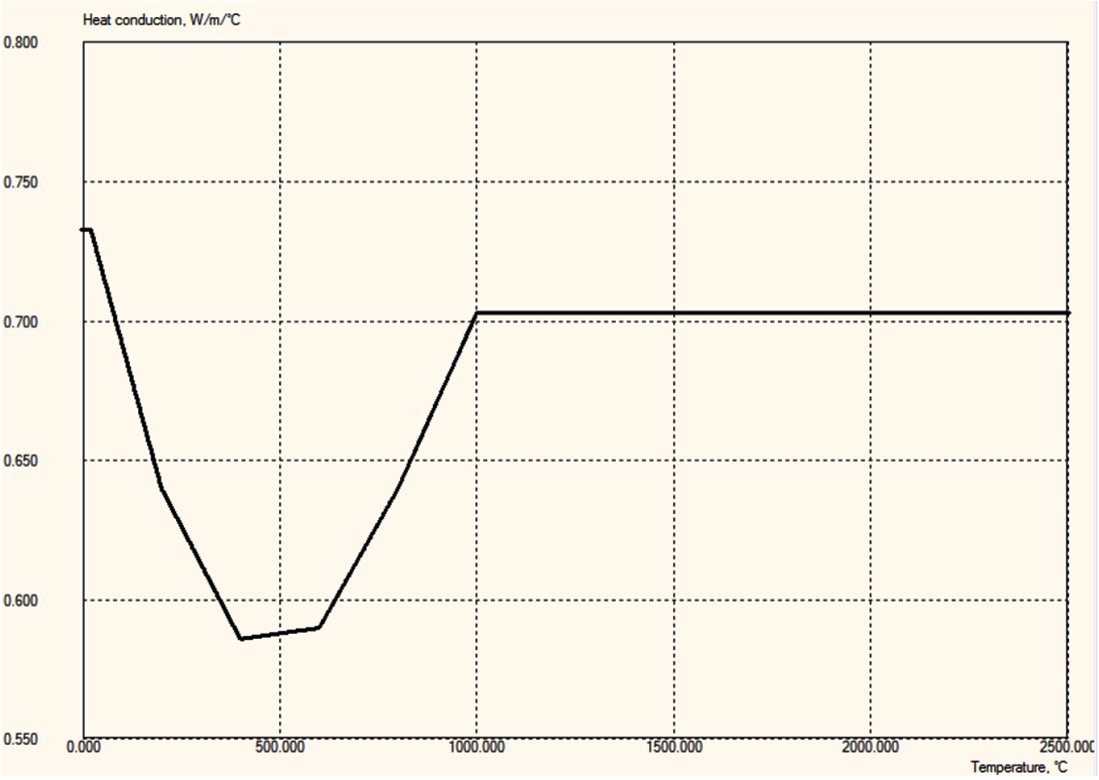


Figure 16 – The change of heat conduction of the mould material (high-silica sand) from the temperature.

The decrease and the subsequent increase of heat conduction of high-silica sand during cooling of gray cast iron occur after the solidus temperature. The maximal value of heat conduction of the mould material at the temperature of 22 °C is 0.732 W/m × °C.

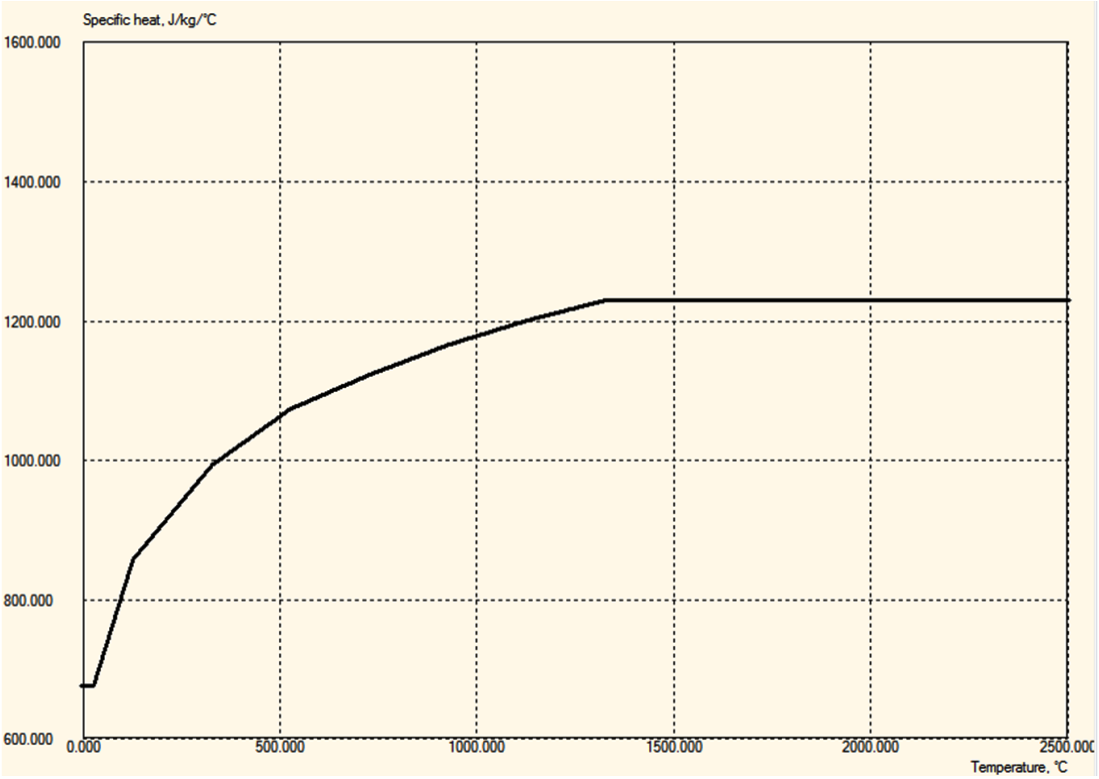


Figure 17 – The change of specific heat of the mould material (high-silica sand) from the temperature.

The decrease in two times of the value of quantity of heat during cooling of the mould material occurs in the temperature range from 1319 to 22 °C.

The main properties of the mould material were taken total emissivity, gas-permeability and rigidity. The set value of gas-permeability it is necessary during the process simulation of the mould filling by melt given of gas (from the mould cavity). The values of these parameters are shown in table 5.

Table 5

The properties of the mould material.

Parameter	Value
Total emissivity	0.93
Gas-permeability	1.53×10^{-6} $m^2/Pa \times s$
Rigidity	1

The created solid model was saved in a file with STL extension for the subsequent import to the program LVMFlow [8]. Into the module «3D Import» it was provided the information about the dimensions of the model and the number of the faces (16562). The number of the faces is set by Step accuracy (1). The model was oriented in the space in accordance with the technological process of casting. Fixation of the model was carried out during pressing of the buttons «Align» for 3 axes.

The fixed model of the casting is presented in Fig. 18.

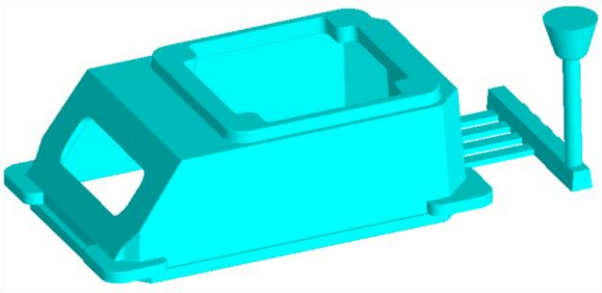


Figure 18 – The uploaded casting and the gating system into the module «3D Import».

After determining of the orientation and fixing of the model, the appropriate information was saved in a file with CVG extension. This file was imported into the module «Initial settings».

For the reduction of the calculation time, the gated pattern was created incompletely. The model casting was inscribed in the calculated field. The dimensions of the field: 693.878 mm (X-axis), 383.16 mm (Y-axis) and 275.978 mm (Z-axis). The position of the model casting in the calculated field according to the corresponding coordinate axes is 346.939 mm, 191.58 mm and 137.375 mm. The dimension of a cell was adopted by the value of 5.307 mm (the number of the cells along X-axis was 131, along Y-axis was 72 and along Z-axis was 52). After generating of a mesh, the total number of the cells was 490464, the casting cells was 41810. For the calculation it was required amount of memory of 413.5 Mb. The lower and higher thickness of the mould according to the coordinate axes was set to the default by the value of 10 mm. The ambient temperature didn't differ from the initial temperature of the mould.

The generated mesh is presented in Fig. 19.

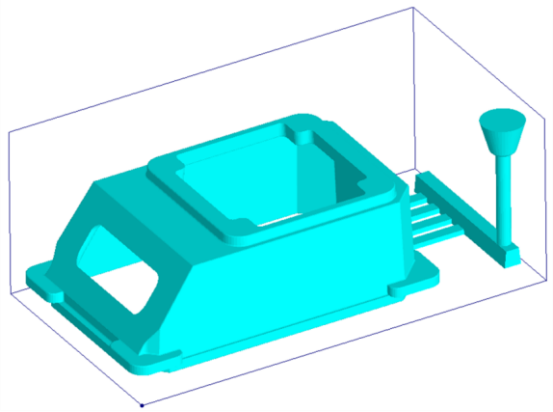


Figure 19 – The mesh creation.

For the alloy it was set the initial temperature of 1325 °C, the liquidus temperature is 1147.608 °C and the solidus temperature is 1147.495 °C. CLF Niyama was adopted of 3 % [9; 10]. The calculated volume of the alloy in the sand mould was amounted to 3964.747 cm^3, the calculated mass of the casting was amounted to 26.169 kg.

The initial temperature of the mould material was taken of 20 °C. The calculated volume of high-silica sand was amounted to 69354.921 cm^3, the calculated mass of the mould material was amounted to 105.399 kg.

The mould cavity was filled by air (at the initial temperature of 20 °C and radiolucency of 1.0).

The contact gap was absent. Upper, lateral and lower coefficients, taking into account the contact properties respectively of top, side and bottom surfaces of the sand mould, were taken of 100 %. The coefficients are used for the fit of forming the air gaps.

The calculated field with the display of the casting material, the mould material and the cavity medium is presented in Fig. 20.

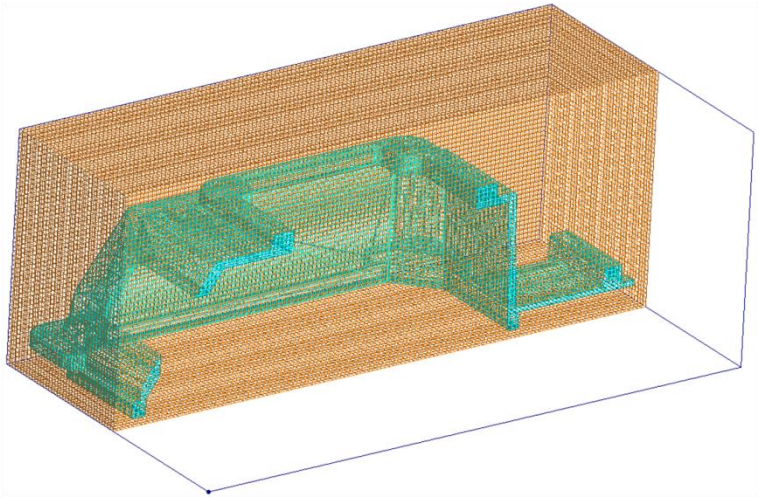


Figure 20 – The calculated field with the display of the casting material, the mould material and the cavity medium.

In the cross section of the pouring basin (XY plane) it was set one gating point. The coordinates of the gating point and direction of melt flow are presented in Fig. 21.

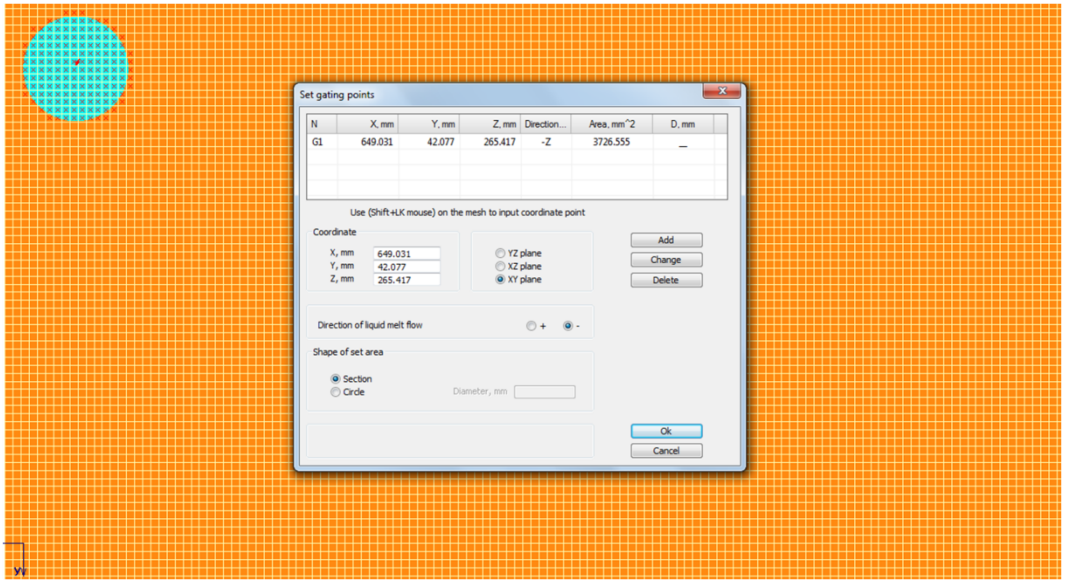


Figure 21 – The set of the gating point.

For measuring of flow of the poured alloy it was set the flowmeter. The dialog window with coordinates of the location of the flowmeter is presented in Fig. 22. The calculation of flow was carried out on the plane of setting of the gating point.

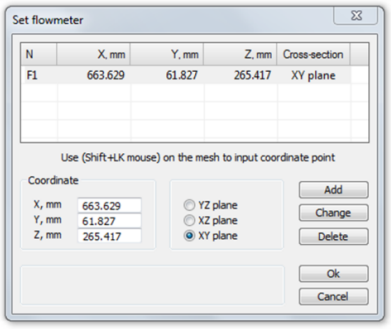


Figure 22 – The set of the flowmeter.

By means of the sensors it is possible to control the change of the some parameters of the casting process. The location of six sensors in the mould cavity is presented in Fig. 23.

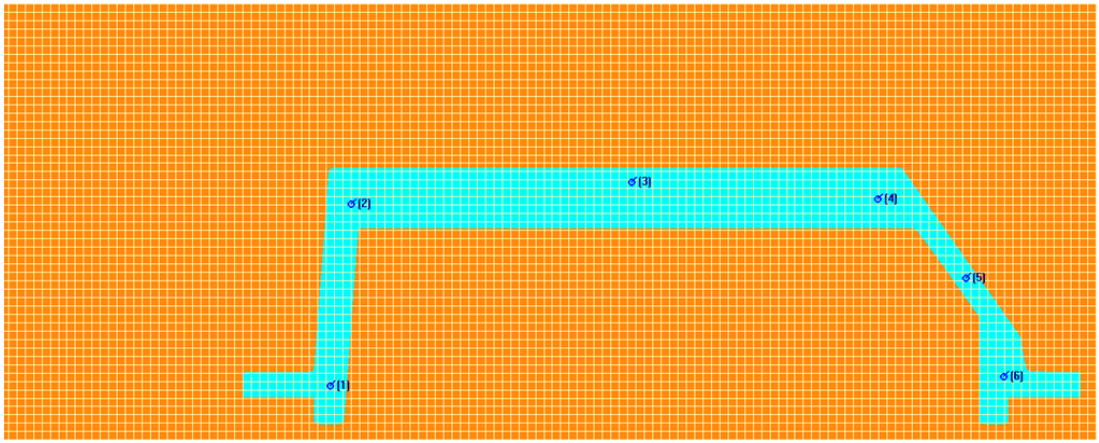


Figure 23 – The set of the sensors.

In the dialog window «Filling parameters» it was set the pouring type – lip pouring. The section area of the gate was amounted to 3726.555 mm^2. Effective pressure head (used for the calculation of initial metal flow through the cross section of the gating system), where it is set the gating point, is called by pressure height. In the dialog window, pressure height PH by the dimension of 85.254 mm will be the distance from which the filling process occurs.

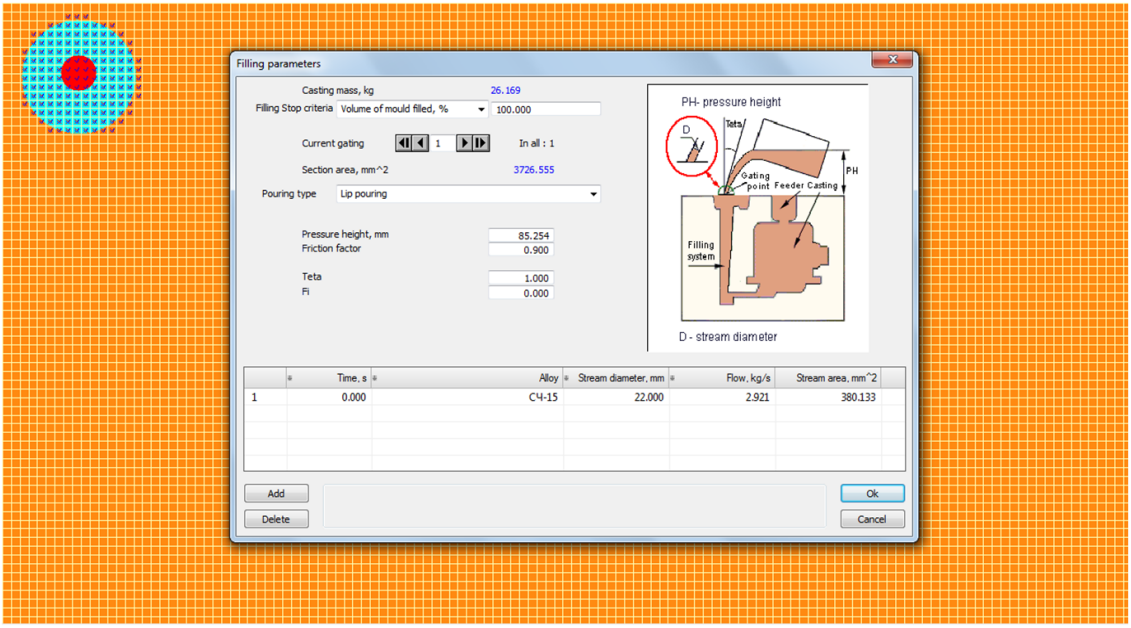


Figure 24 – The filling parameters of the sand mould by melt.

The friction factor characterizes the resistance in the gating system. The friction factor was taken of 0.9. The projection angle of the stream of metal on the plane with X-axis (Teta) was taken by the value of 1°. The stream diameter (22 mm) of melt was set given of the dimensions of the sprue (in the cross section it is displayed by the red color). The values of the stream area and melt flow are calculated automatically and are amounted to 380.133 mm^2 and 2.921 kg/s respectively. The established filling parameters of the sand mould by melt are presented in Fig. 24.

The information with the initial settings was saved in a file with SIM extension. The descriptor (a file with PSP extension) was created automatically.

The simulation parameters are presented in table 6.

Table 6

The simulation parameters.

Type of cycling	Without cycling
Calculation model	Quasi-equilibrium, without segregation, without taking gas into account at filling, without convection. Aggressive AMG, The Gauss-Seidel method [11]
Coefficient of turbulence	0
Gravity influence coefficient, %	50 (medium gravity)
Interfacial heat transfer model	Air gap
Number of start up thread	4
Physical properties for simulation	Calculated by phases
Ratio volume/surface area, %	1
Maximal step for solid, s	7.98
Filling stop criteria	Volume of mould filled 100 %
Time intervals, s	From 0 to 100, step 10
Filed volume intervals, %	From 0 to 100, step 10
Liquid phase intervals, %	From 100 to 80, step 5
Maximum temperature intervals, °C	From 1500 to 20, step 100

The wire model of the casting and the gating system in Fig. 25 are the channels for filling of melt. The calculation time of the casting process was amounted to 2010 seconds.

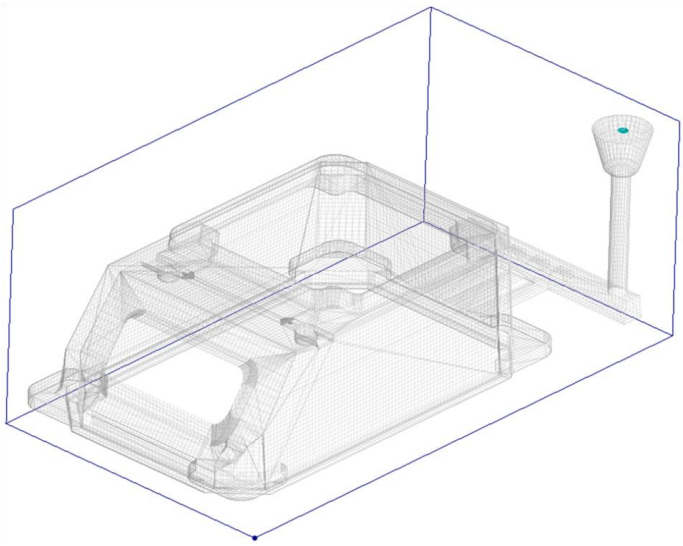


Figure 25 – The wire model of the casting and the gating system before the calculation process.

Results and discussion

The work [12] presents the analysis of the solidification process of non-alloy cast steel with the different wall thickness of the casting. On the basis of the derived dependence it was received the coefficient for definition of the solidification time of the casting.

The results of this research are the calculated fields on the model of the iron casting, characterizing the change of the casting parameters in the sand mould in accordance with the color scale. The simulation of the casting process in the sand mould of the case-shaped casting is described in the work [13].

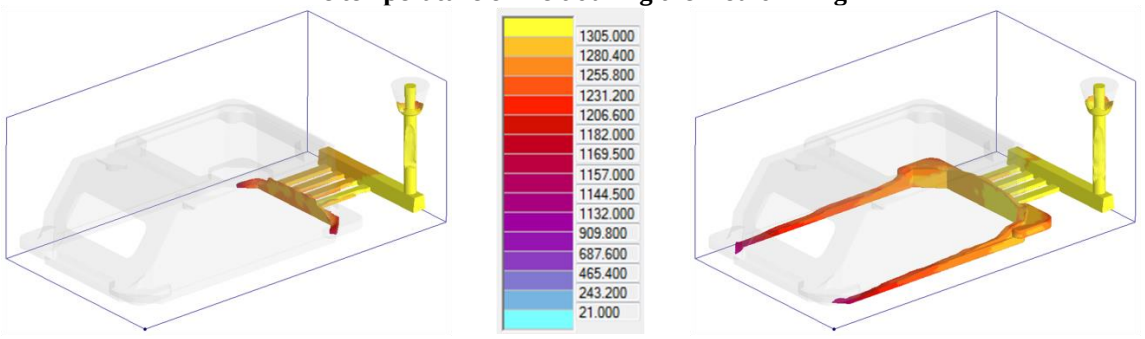
The calculated fields of the temperature change of melt during the mould filling and subsequent cooling are presented in table 7.

The calculated time of the mould filling by melt was amounted to 9.106 s. The calculated time of cooling (solidification) of melt in the sand mould was amounted to 396.185 s. The total time of casting in the sand mould was amounted to 405.291 s. The step of storing of the calculated field for the mould filling by melt was amounted to 0.9 s.

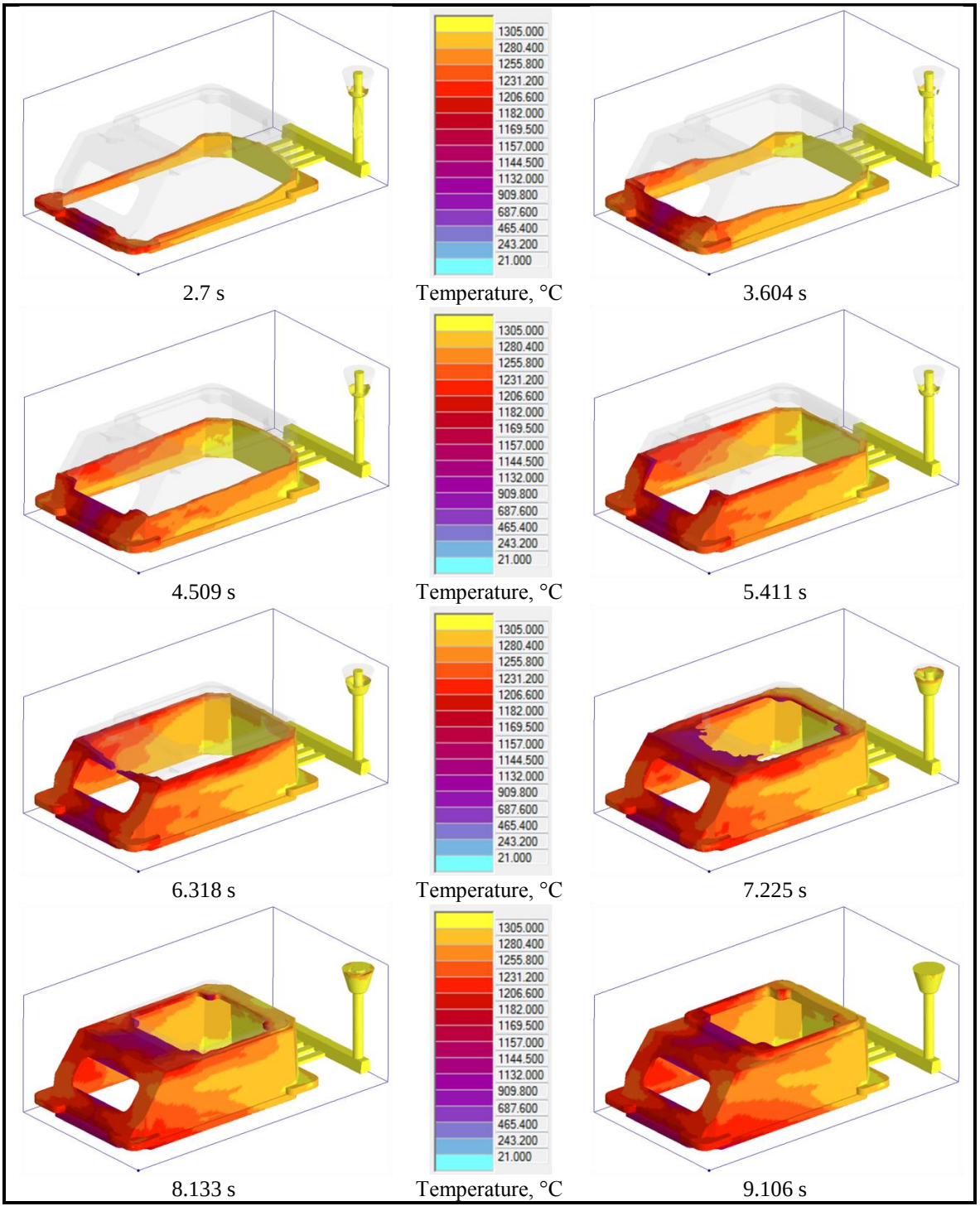
Table 7

The temperature of melt (filling and cooling).

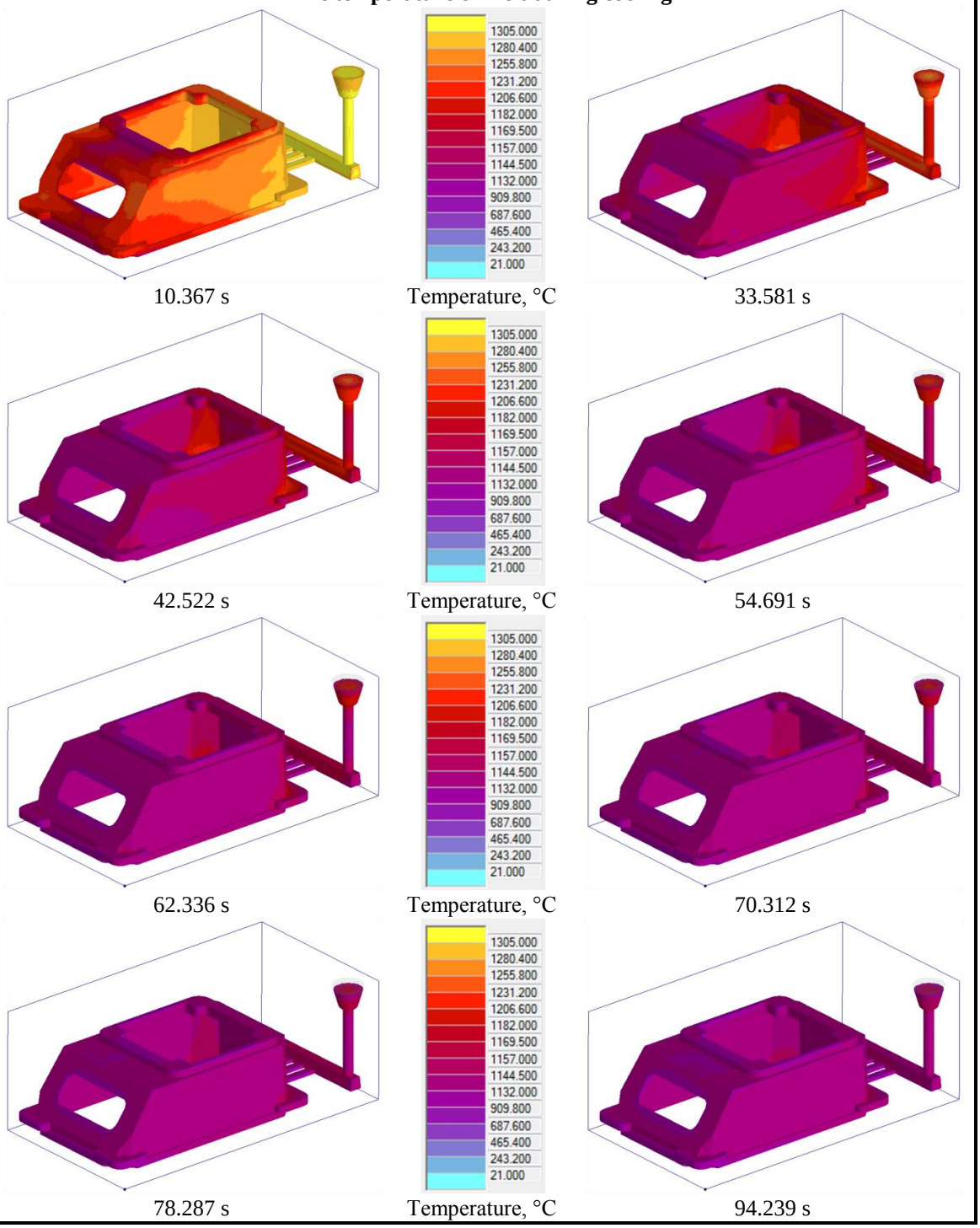
The temperature of melt during the mould filling

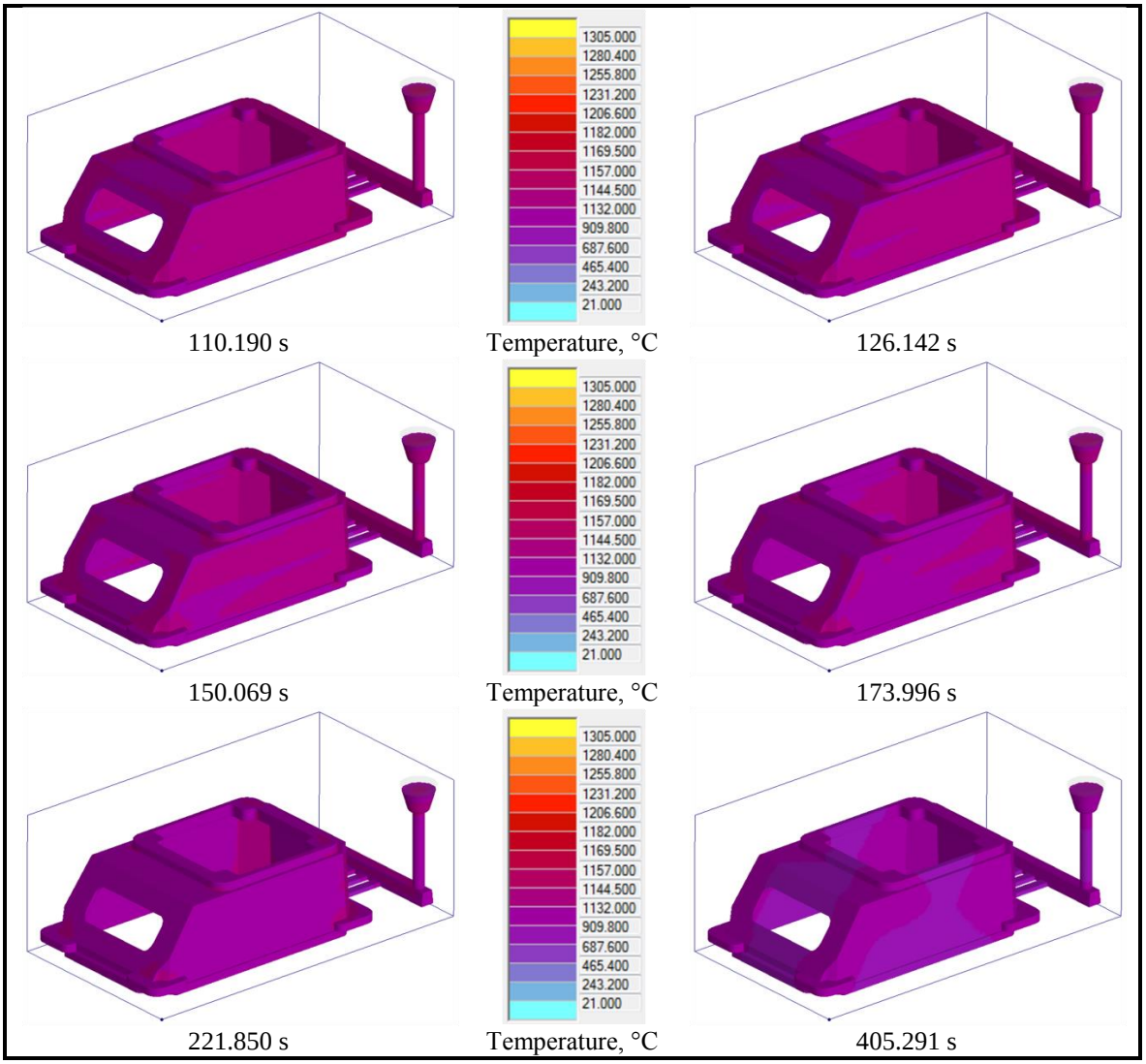


0.9 s | Temperature, °C | 1.801 s


1305.000
1280.400
1255.800
1231.200
1206.600
1182.000
1169.500
1157.000
1144.500
1132.000
909.800
687.600
465.400
243.200
21.000
Temperature, °C
2.7 s
3.604 s
4.509 s
5.411 s
6.318 s
7.225 s
8.133 s
9.106 s

The temperature of melt during cooling



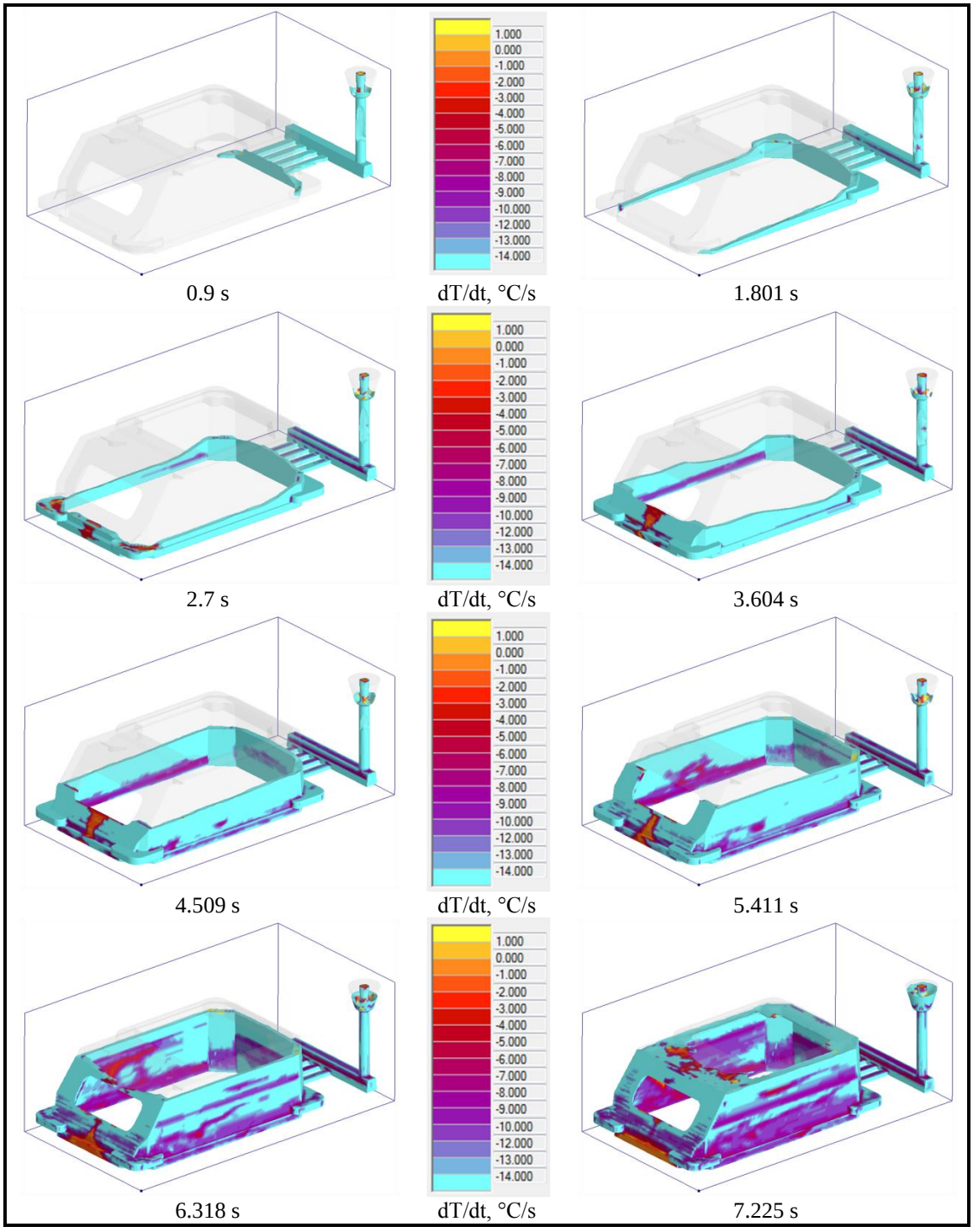


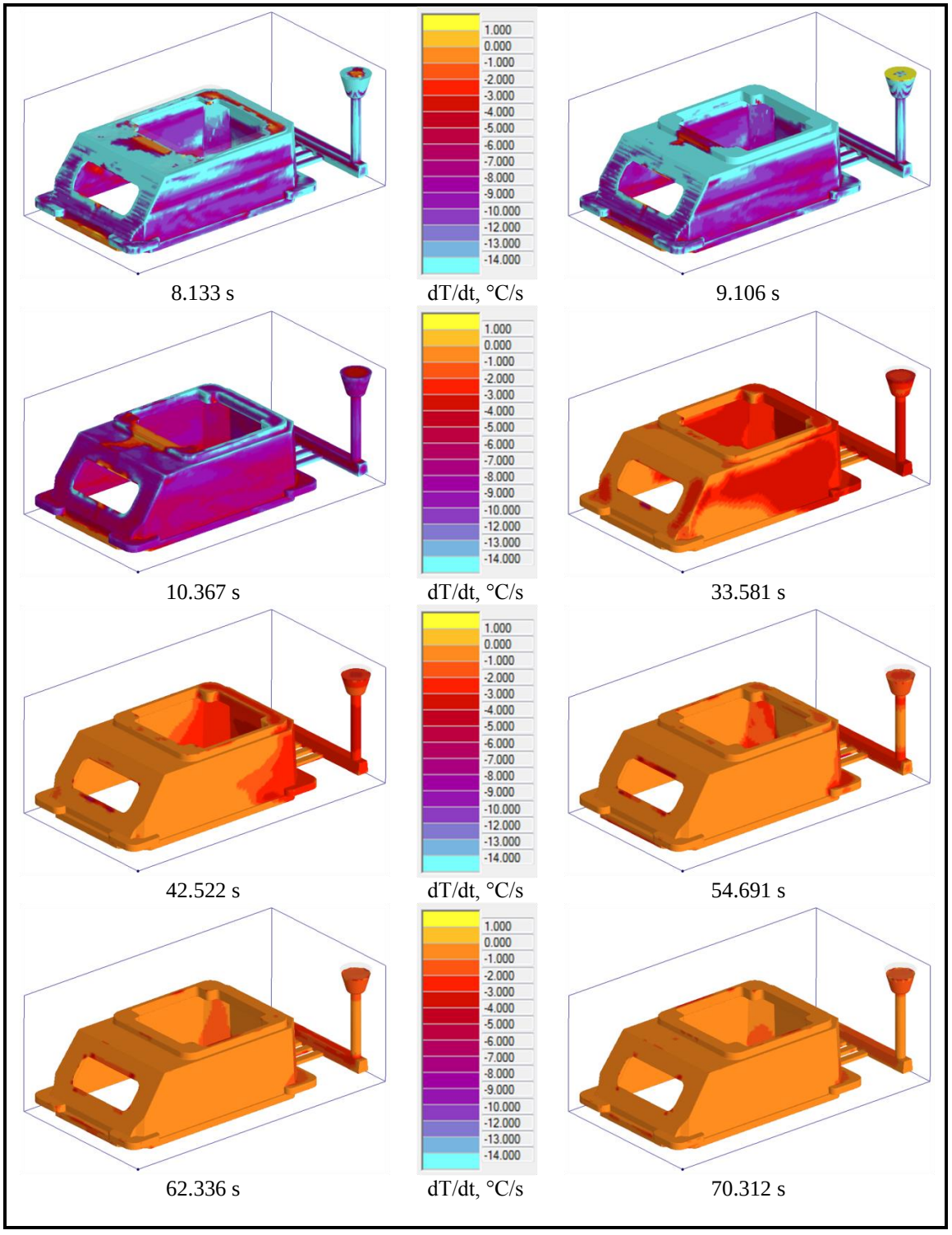
The analysis of the calculated fields of the temperature change of melt during the mould filling shows that during the first 3.604 s the temperature decreases in relation to the initial temperature by about 9 %. Melt, which is more distantly from the (gates) feeders, has the temperature close to the liquidus temperature. Cooled of the casting is slower than during filling, because there is only the heat transfer process. During filling, energy is expended on the motion of melt in the channels of the mould. The temperature during solidification of grey cast iron was about 450 °C.

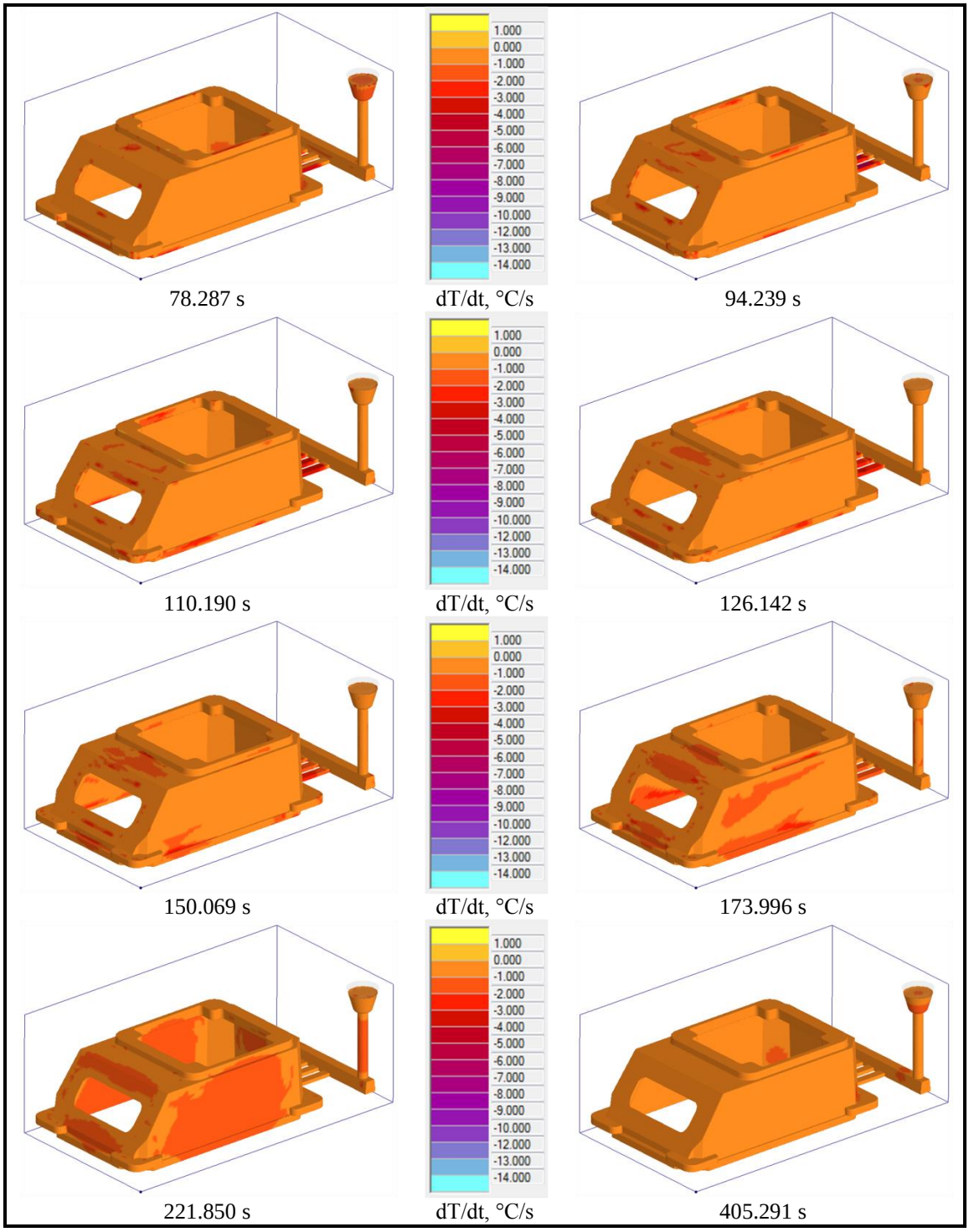
The calculated fields of ratio of the temperature change of melt during the mould filling and subsequent cooling to change the time of casting are presented in table 8.

Table 8

Ratio of the temperature change of melt to change the time of casting.




1.000
0.000
-1.000
-2.000
-3.000
-4.000
-5.000
-6.000
-7.000
-8.000
-9.000
-10.000
-12.000
-13.000
-14.000
8.133 s
dT/dt, °C/s
9.106 s
10.367 s
dT/dt, °C/s
33.581 s
42.522 s
dT/dt, °C/s
54.691 s
62.336 s
dT/dt, °C/s
70.312 s

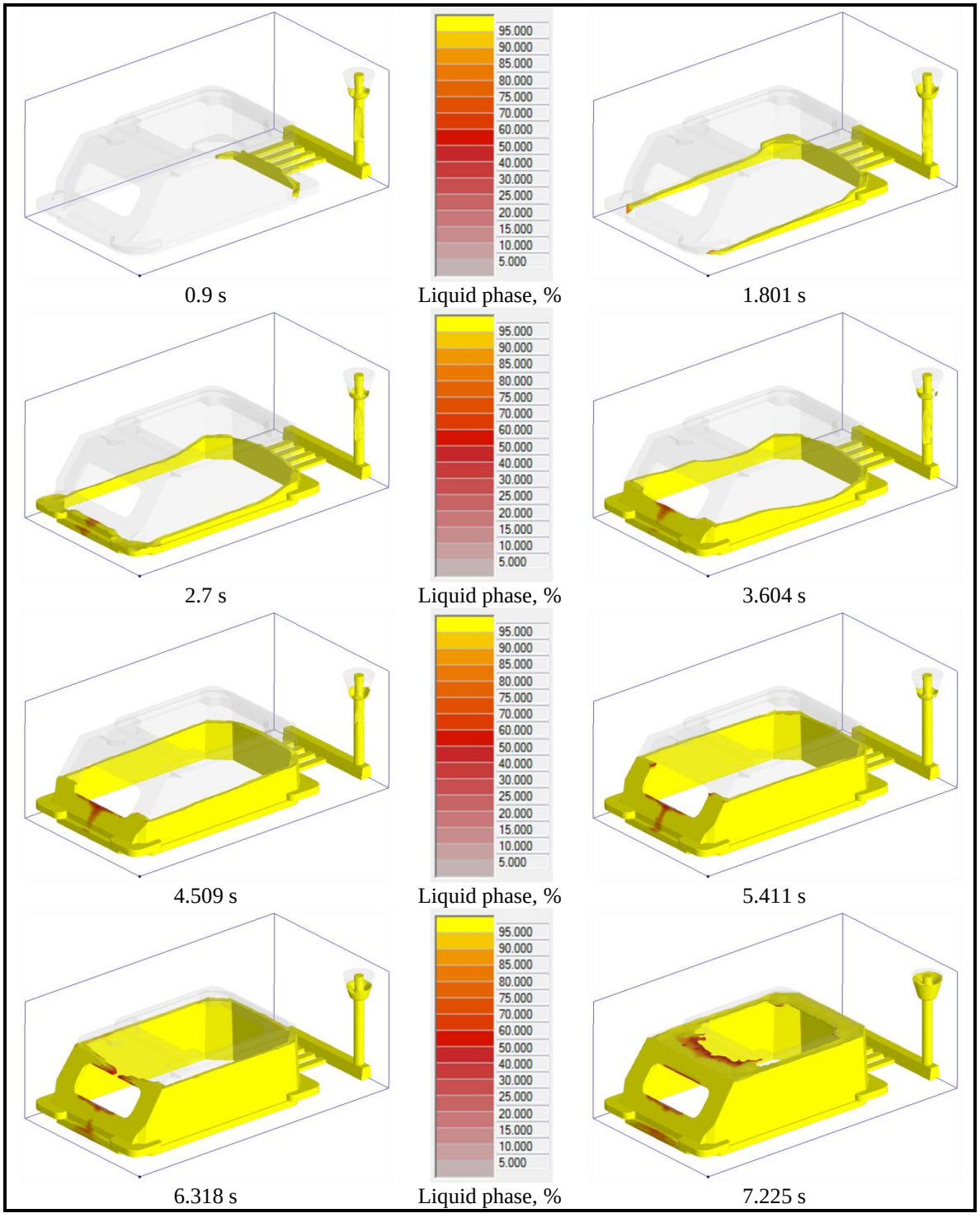


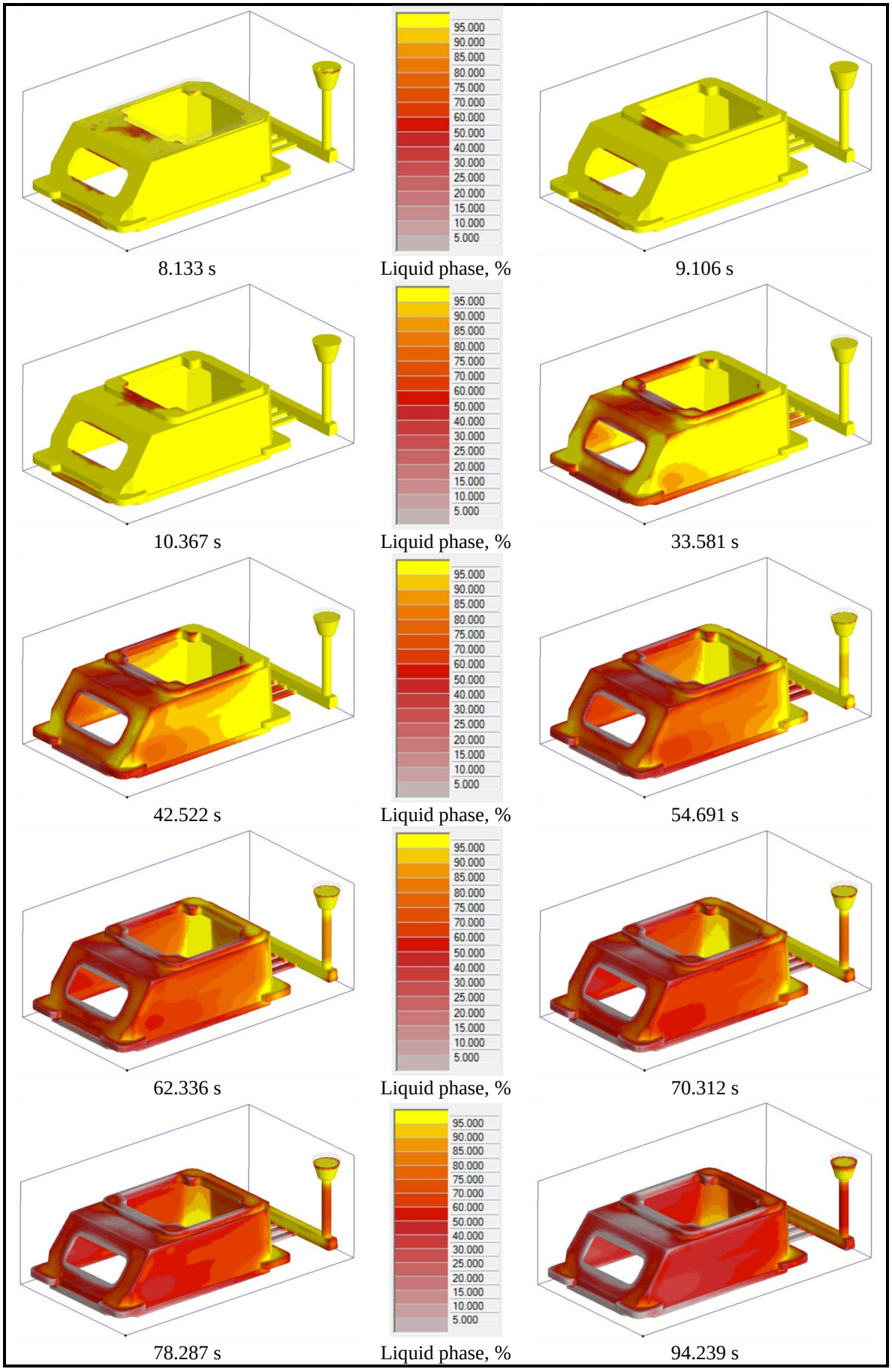
The first 3.604 s of the process of the mould filling are characterized by almost same cooling rate of melt. On the next 3.621 s of the mould filling it is observed the deceleration of cooling rate of melt. The process of melt solidification is occurred with uniform cooling rate. On the finite interval of the solidification time, energy of the inner layers of the casting material is transferred by the outer layers, therefore, there is the increase of cooling rate.

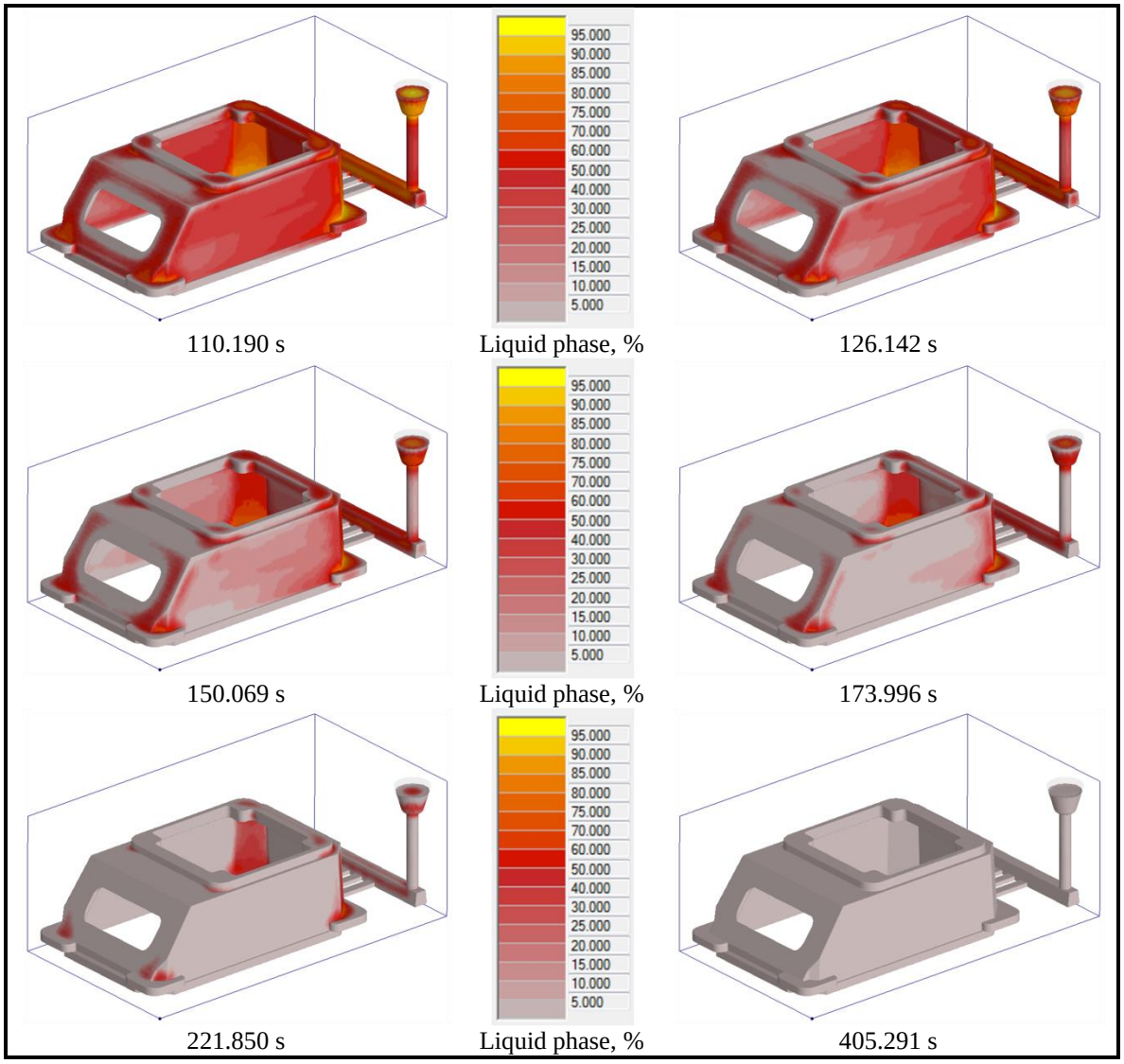
The calculated fields of the fraction of the liquid phase of the alloy during filling of the mould and subsequent cooling are presented in table 9.

Table 9

The fraction of the liquid phase of the alloy (filling and cooling).




95.000
90.000
85.000
80.000
75.000
70.000
60.000
50.000
40.000
30.000
25.000
20.000
15.000
10.000
5.000
8.133 s
Liquid phase, %
9.106 s
10.367 s
Liquid phase, %
33.581 s
42.522 s
Liquid phase, %
54.691 s
62.336 s
Liquid phase, %
70.312 s
78.287 s
Liquid phase, %
94.239 s



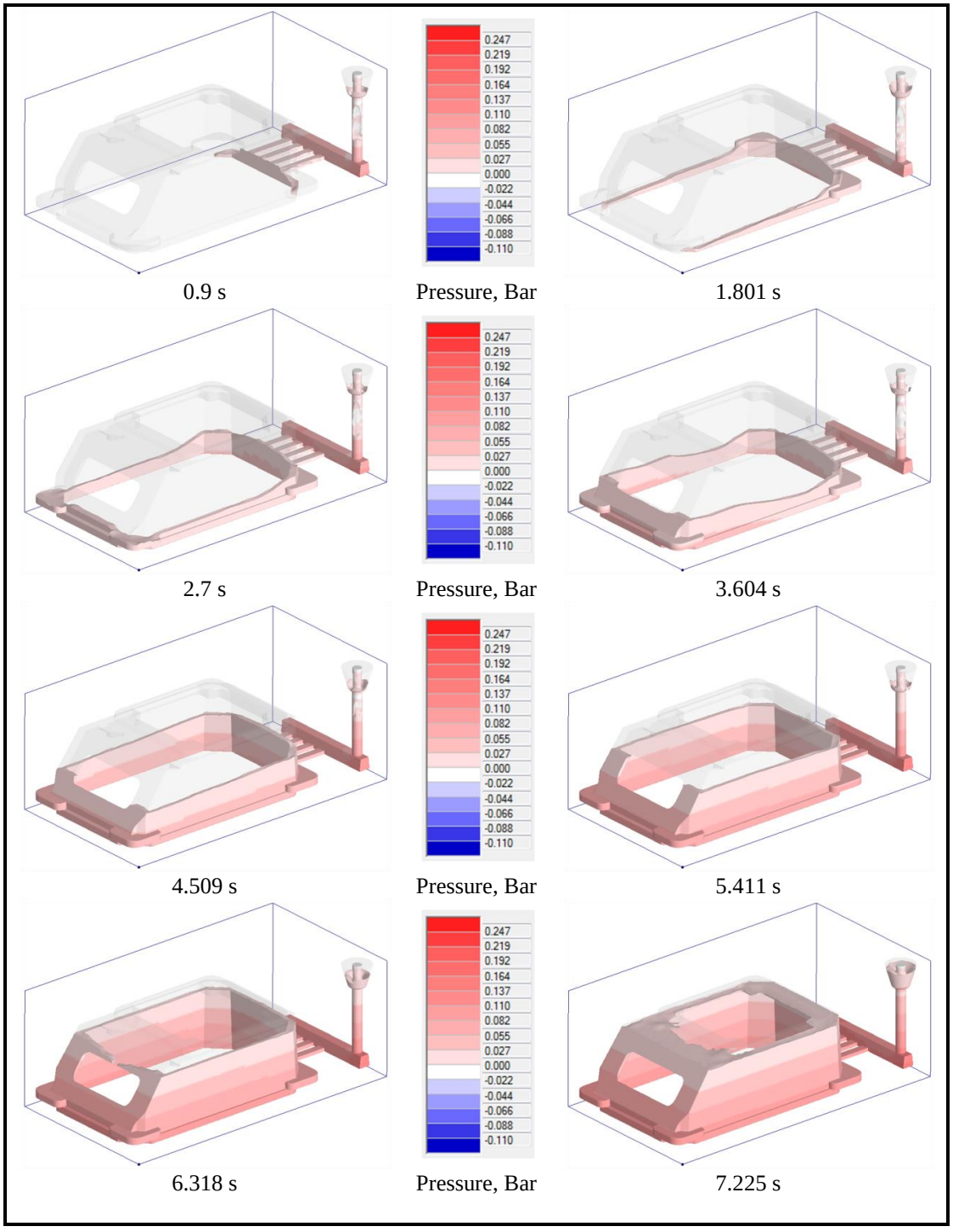
In accordance with the calculated fields, it is possible to observe that to complete filling of the channels of the mould, the alloy is in the liquid state. The exceptions are the some volumes of the alloy (approximately 5 %) at the bottom part and the side window of the casting. The volume of the alloy poured into the mould is solidified unevenly. The crystallization process is slower on the angular bends of the casting. This may affect on its quality, because in these places there are residual deformations of the material. The forecast of the formation of residual deformations is correct and for the bottom of the casting.

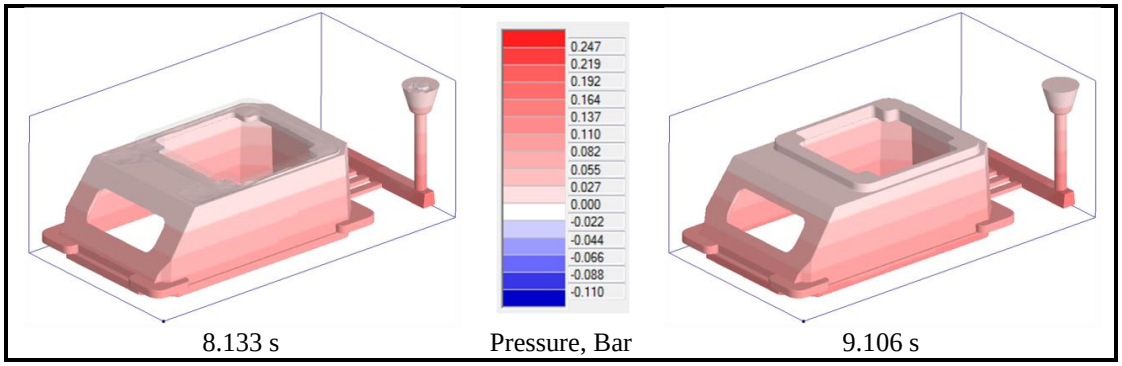
The calculated fields of pressure in melt during filling of the mould are presented in table 10.

During the mould filling, pressure in melt is changed in the range from 0.02 to 0.05 bar. The side surfaces of the casting are exposed by variable pressure.

Table 10

Pressure in melt during filling of the mould.



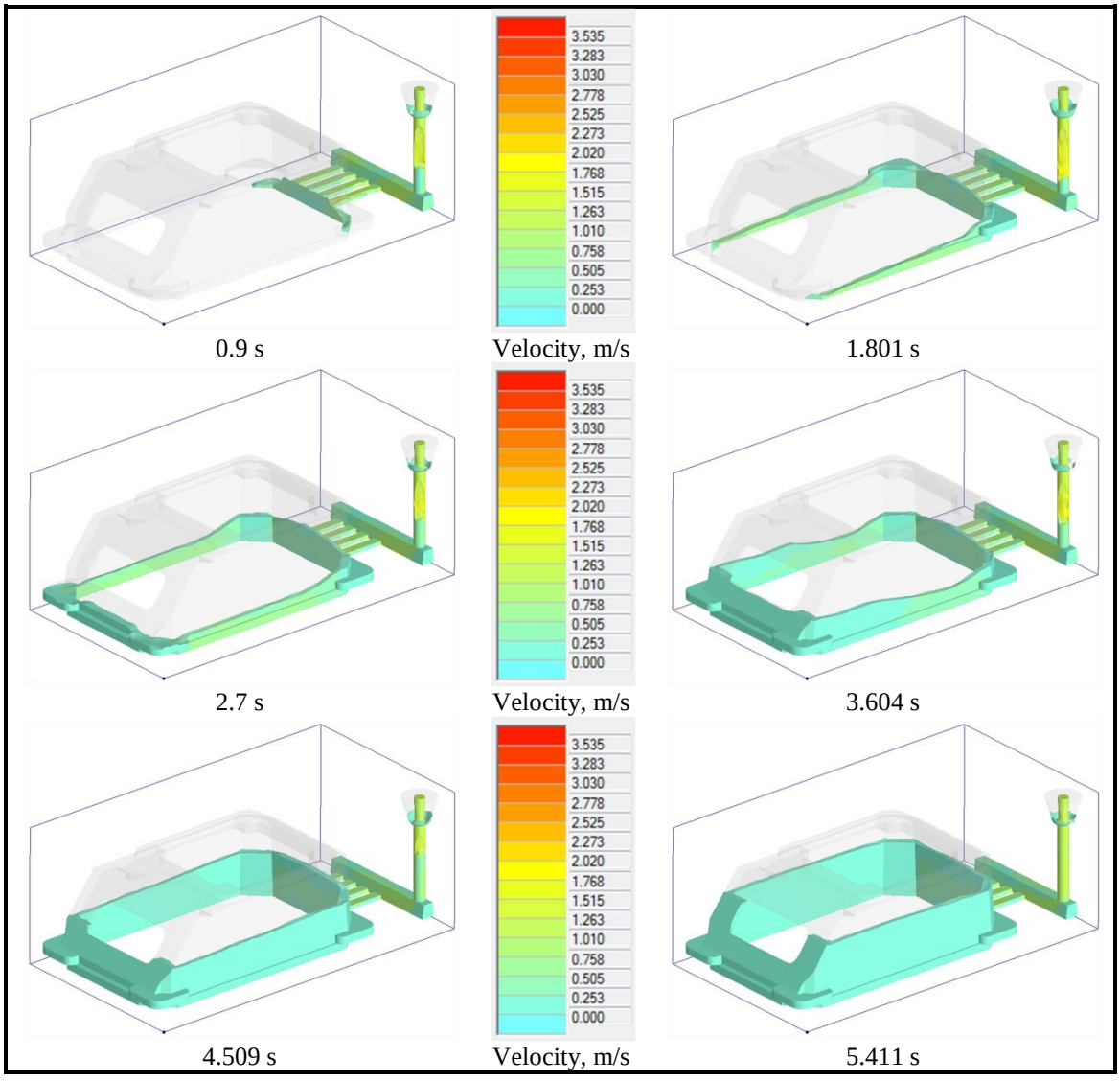


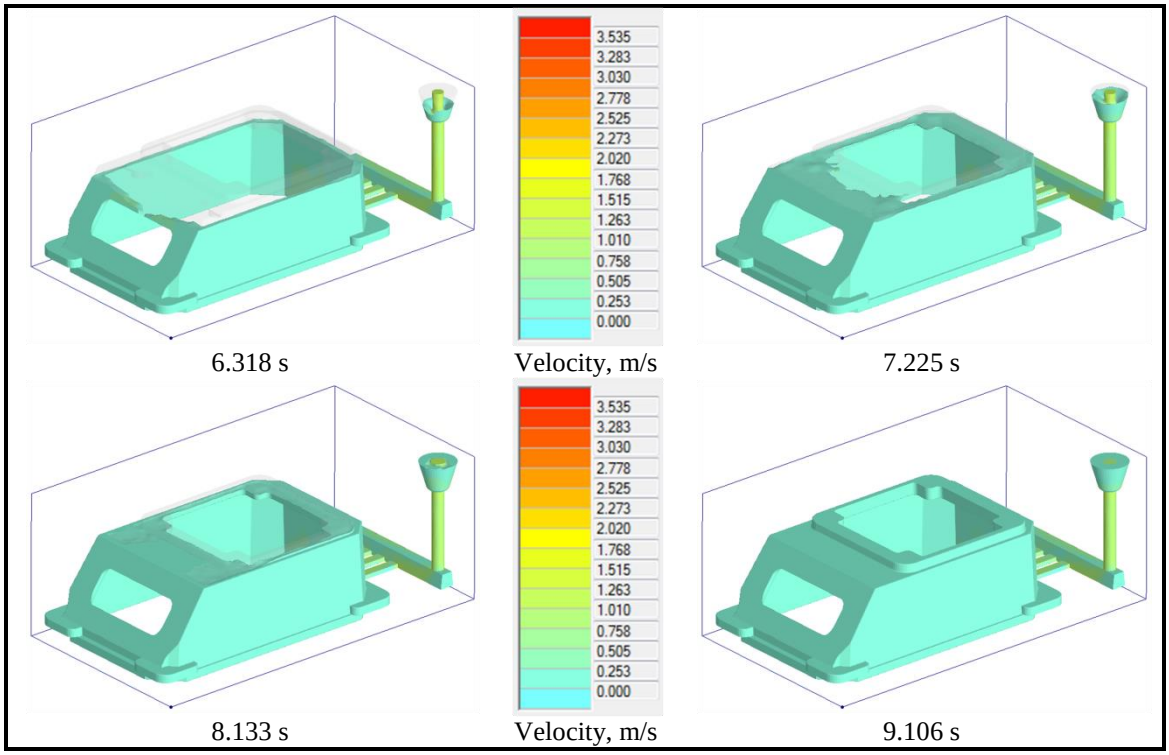
The least pressure is concentrated at the bottom part of the casting, the highest pressure is concentrated on the top part of the casting. The calculated fields of the velocities of melt during filling of the mould are presented in table 11.

The velocity of melt flow doesn't change throughout of the mould filling because casting occurs without the application of external pressure, but only under the action of the gravitational forces. It speaks about a uniform distribution of melt throughout the volume of the mould.

Table 11

The velocities of melt during filling of the mould.





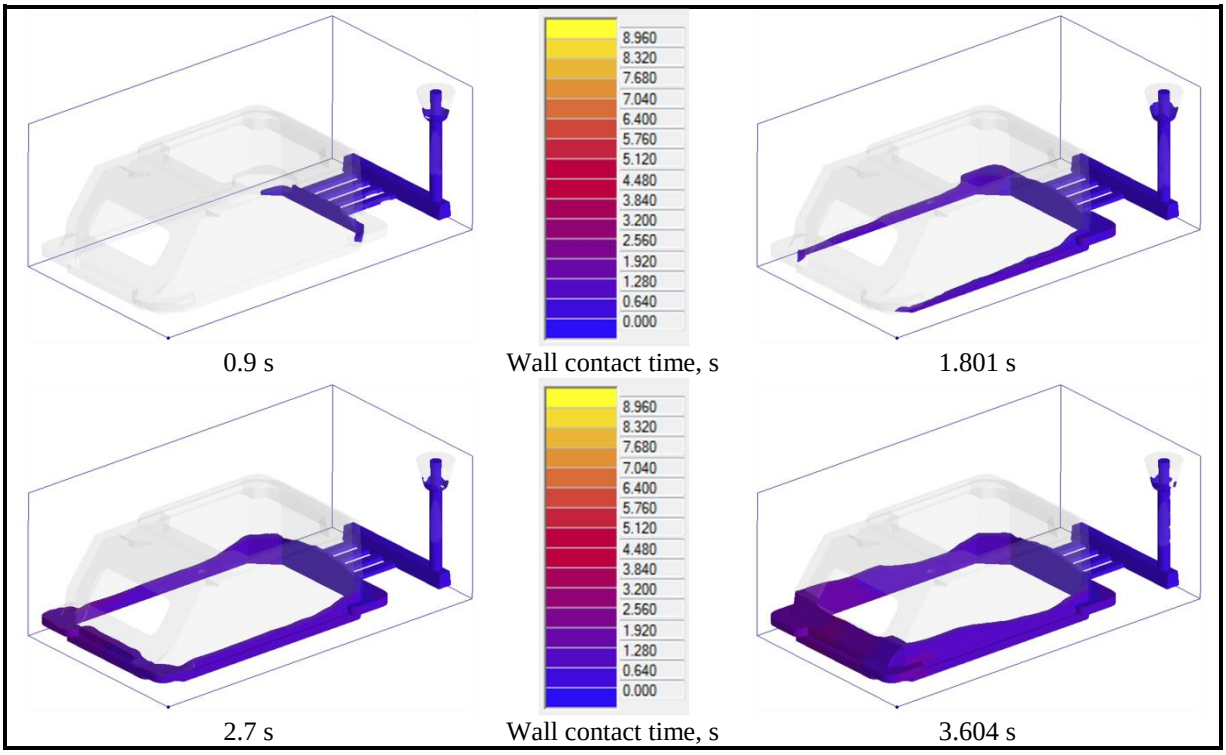
The calculated fields of the contact time of melt with the walls of the mould are presented in table 12.

The contact time of melt with the walls of the mould is less the filling time. This is due to the fact that liquid alloy flows from layer to layer and has the minimal contact with the walls of the channels of the sand mould.

The calculated field of work effectiveness of the gating-feeding system is presented in table 13.

Table 12

The contact time of melt with the walls of the sand mould.



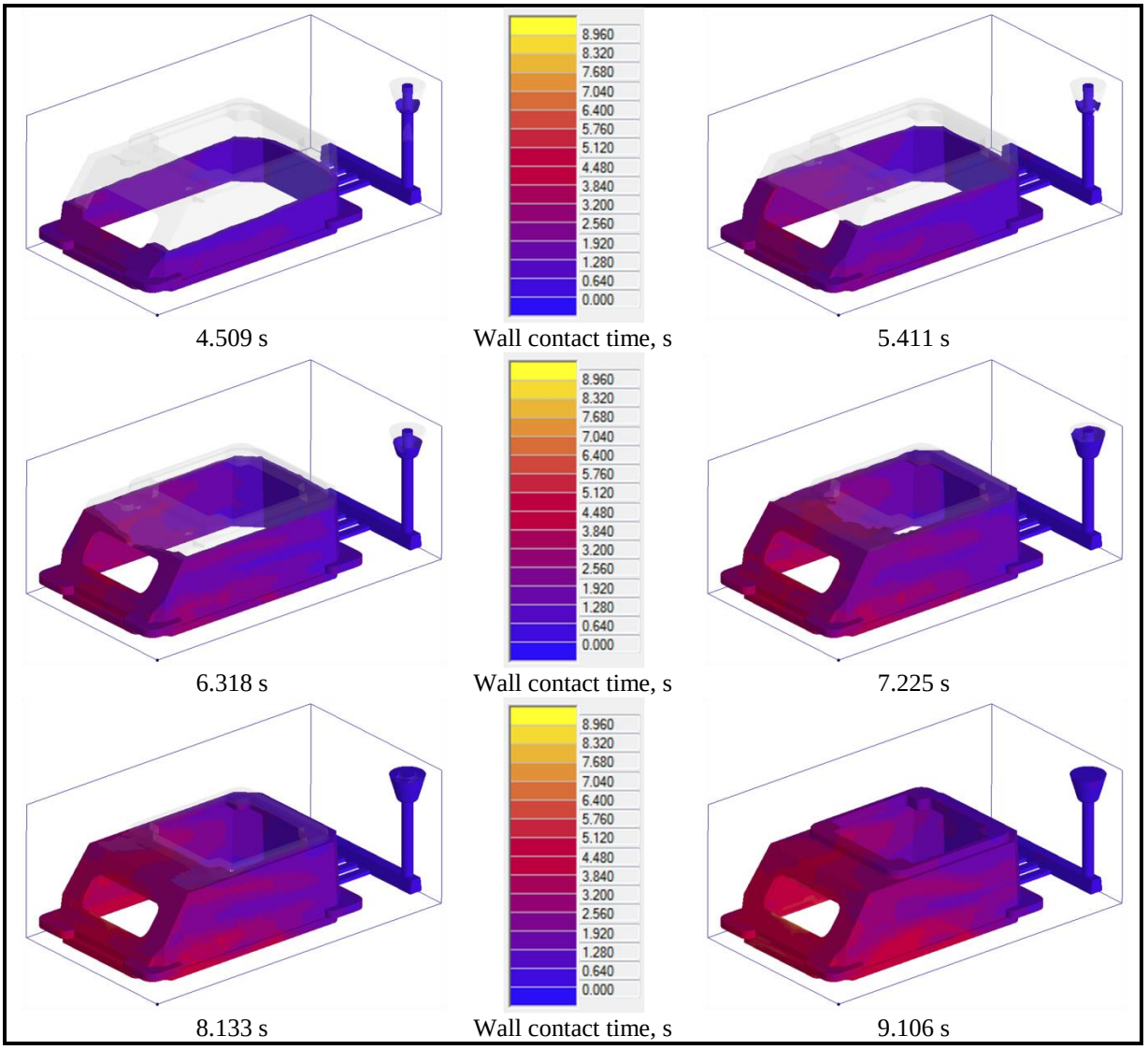
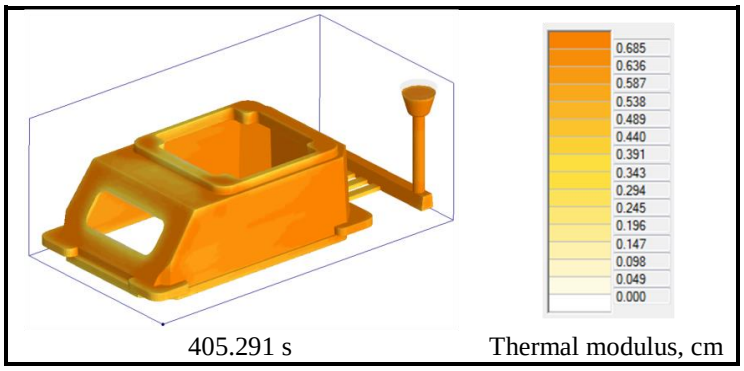


Table 13

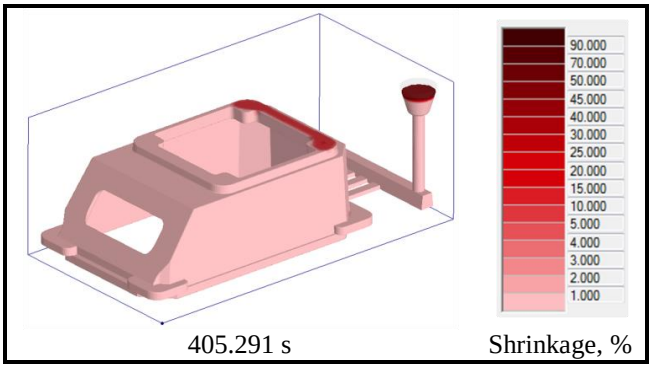
The assessment of effectiveness of the gating-feeding system.



The calculated field of volumetric shrinkage of the casting material is presented in table 14. As a result of the occurrence of shrinkage, the casting volume after solidification in the sand mould was amounted to 98 %.

Table 14

Volumetric shrinkage of the casting material.



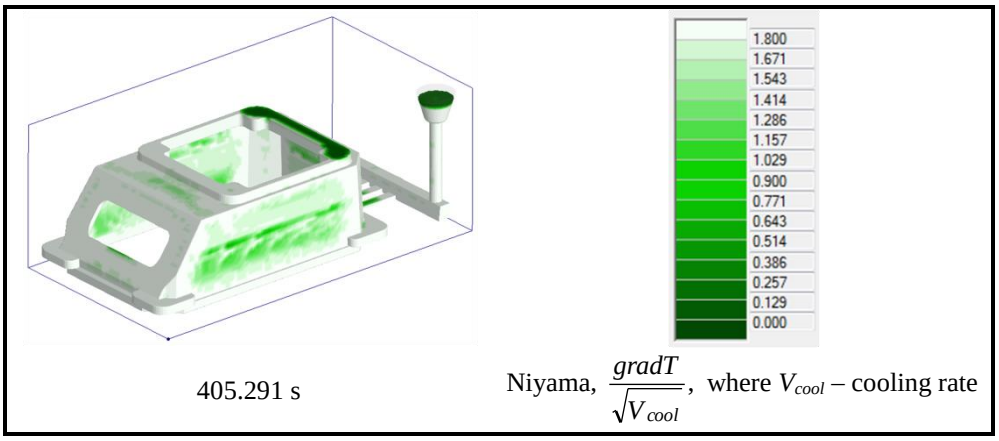
The thermal modulus is ratio of the casting volume to its surface (*V*/*s*). For determination of the thermal modulus it is used the following formula: $m = k\sqrt{t}$, where $k = \frac{1}{\sqrt{t_0}}$ – the coefficient of proportionality, t – the solidification time of the casting (in seconds), t_0 – the crystallization time of the material by a diameter of 1 cm (in seconds). Insufficient risering is observed on the most darkened areas of the model.

In accordance with the basic technological process, calculated volumetric shrinkage of the casting material doesn't exceed the permissible value of shrinkage. However, in the bottom part of the casting, volumetric shrinkage was amounted to 10 %. This defect is the result of uneven solidification of the casting in the sand mould. For elimination of this defect it is necessary to perform the calculation of the dimensions of the (gates) feeders of the gating system.

The calculated field of the Niyama criterion for the casting material is presented in table 15.

Table 15

The Niyama criterion for the casting.



The Niyama criterion allows to predict the forecast of the formation of microporosity and shrinkage porosity in the casting material. The criterion is determined from ratio of the temperature gradient to cooling rate of the casting. The values of the both parameters are taken at the end of solidification of the casting. Then the less value of the Niyama criterion, that there is the more probability of the formation of shrinkage porosity. In accordance with the calculated field, shrinkage porosity is formed in the bottom part and on two symmetrical side walls of the casting.

The calculated values of parameters of the casting process in the sand mould are presented in the summary table 16.

Table 16

The parameters of the casting process.

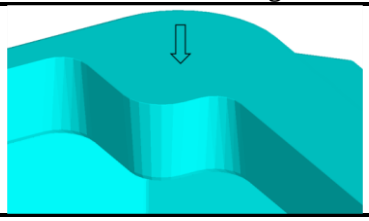
Time, s	Filled volume, %	Mass, kg	Liquid phase, %	Volume shrinkage, %	$T_{max.}$, °C
0.004	0.1	0.02	100	0	1325
0.9	10	2.63	100	0	1325
1.801	20	5.26	99.9	0	1325
2.7	30	7.89	99.9	0	1325
3.604	40	10.53	99.9	0	1325
4.509	50	13.17	99.8	0	1325
5.411	60	15.8	99.8	0	1325
6.318	70.1	18.46	99.8	0	1325
7.225	80.1	21.1	99.7	0	1325
8.133	90	23.76	99.7	0	1325
9.106	100	26.53	99.6	0	1325
10.367	100	26.53	99.5	0	1324.2
33.581	99.3	26.53	94.2	0.65	1286.3
42.522	99.2	26.53	89.4	0.83	1263.6
54.691	99	26.53	81.7	0.96	1235.4
62.336	99	26.53	76.6	1	1219.2
70.312	99	26.53	71.3	1.03	1203.5
78.287	98.9	26.53	66	1.06	1189
94.239	98.9	26.53	56	1.08	1163.4
110.190	98.9	26.53	46.9	1.1	1147.3
126.142	98.9	26.53	38.6	1.11	1146.5
150.069	98.8	26.53	27.7	1.12	1145.7
173.996	98.8	26.53	18.9	1.13	1145.1
221.850	98.6	26.53	8.9	1.14	1144
405.291	98	26.53	0	1.14	1106.8

For the feeder size calculation it was used the algorithm NovaCast Foundry Solutions AB [14]. The required quantity of the feeders was determined on the basis of the calculated fields of the casting with shrinkage. Ratios feeder/casting and neck/casting depend on the grade of the alloy and the peculiar properties of the solidification process. For gray cast iron ratios were taken by the values of 1 and 0.7 respectively.

The feeder size calculation for reduce of shrinkage in the bottom part of the casting is given in table 17.

Table 17

The feeder size calculation.

Selection of the casting node	
	
Input data	
Alloy density, kg/m^3	6761.017
Casting modulus, cm	0.84
Casting weight to be fed, kg	26.806
Minimum feed metal requirement, %	2.374
Minimum modulus ratio feeder/casting	1

Feeder ratio height/diameter	1.5
Modulus ratio neck/casting	0.7
Feeder type	Cylinder
Mould hardness	80
Location	Top
Result	
Minimum feeder modulus, cm	1.422
Actual modulus ratio feeder/casting	1.692
Feed metal requirement, cm^3	131.781
Feeder weight, kg	3.472
Modulus feeder neck, cm	0.588
Feeder neck dimension square, mm	23.531
Minimum feeder diameter, mm	75.821
Minimum feeder height, mm	113.731

Thus, for supply of the alloy it is necessary the feeder with a minimum diameter of 75.821 mm.

The readings of the temperature, cooling rate, the fraction of the liquid phase, the velocity, pressure, flow and quantity of heat of the alloy from the time of the casting process, obtained from six sensors are presented in Fig. 26 – 32.

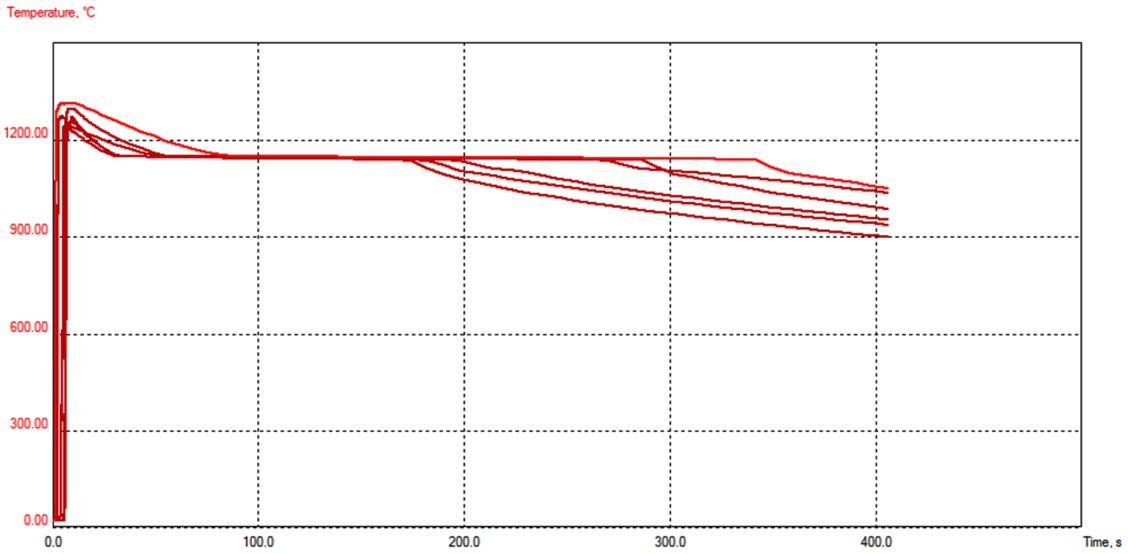


Figure 26 – The dependencies of the temperature of melt from the time of the casting process.

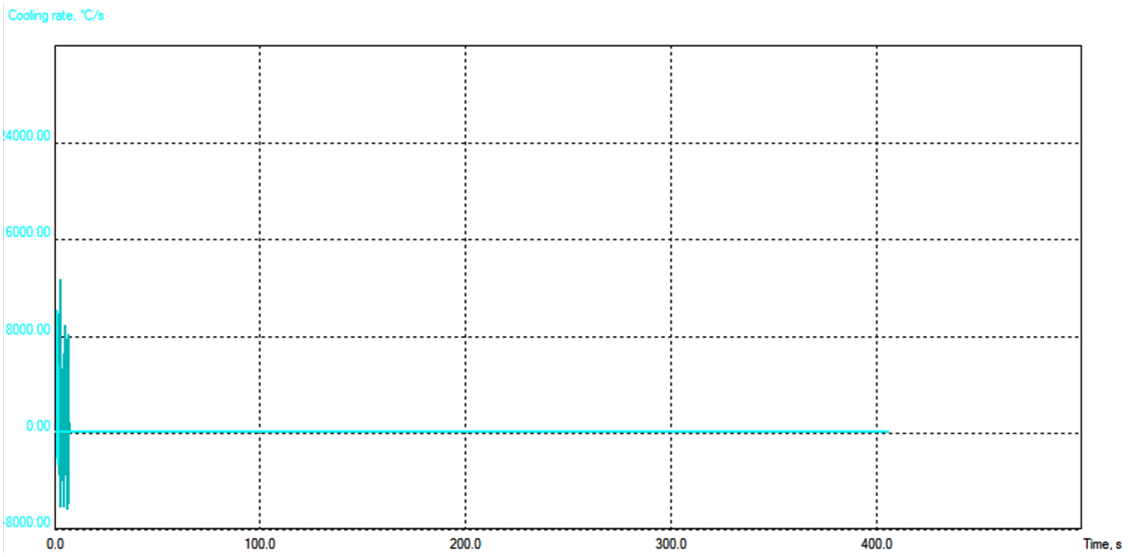


Figure 27 – The dependence of cooling rate of melt from the time of the casting process.

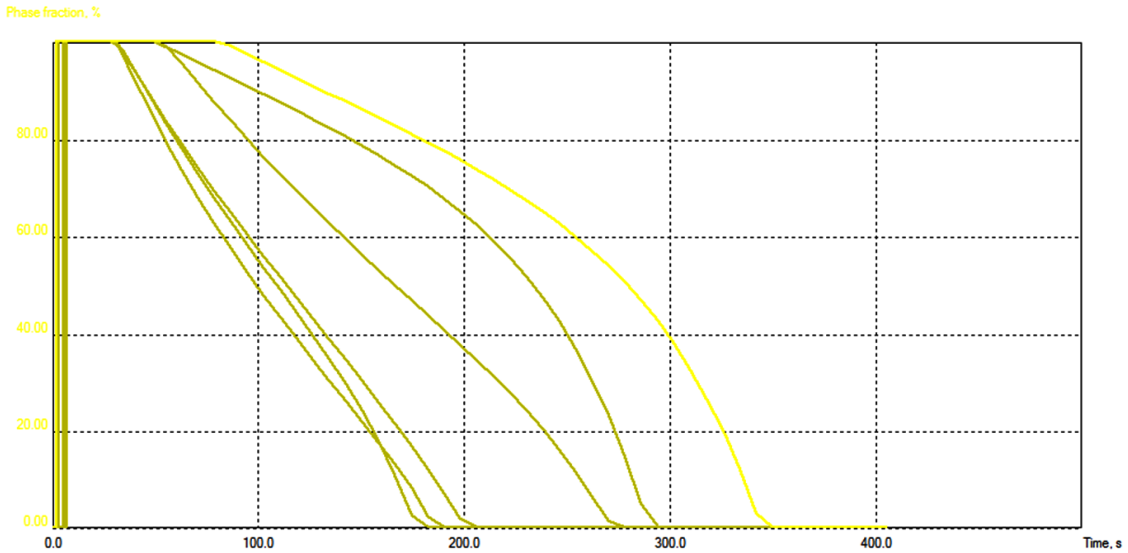


Figure 28 – The dependencies of the phase fraction of melt from the time of the casting process.

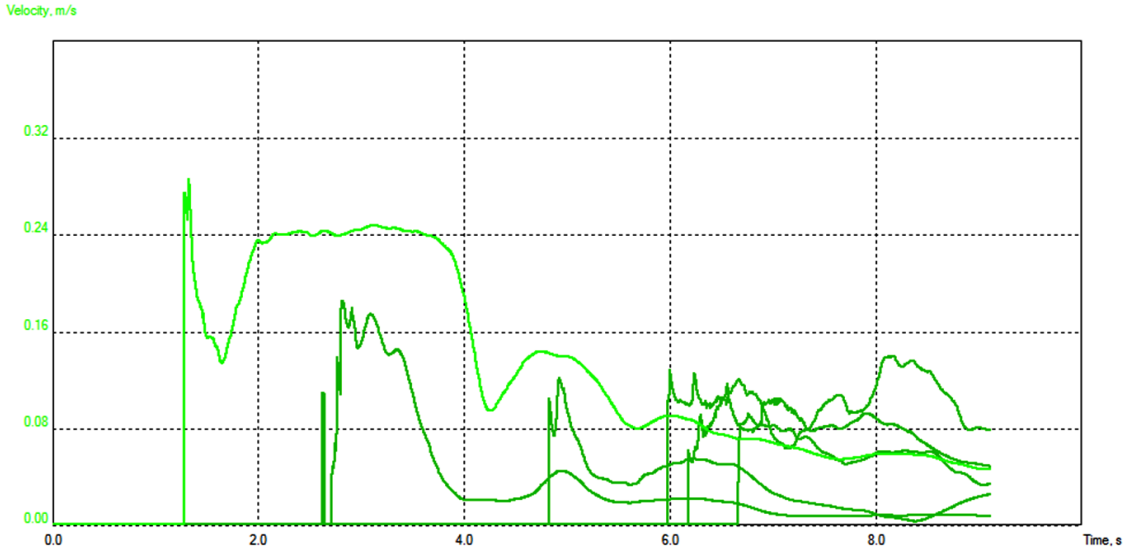


Figure 29 – The dependencies of the flow velocity of melt from the time of the mould filling.

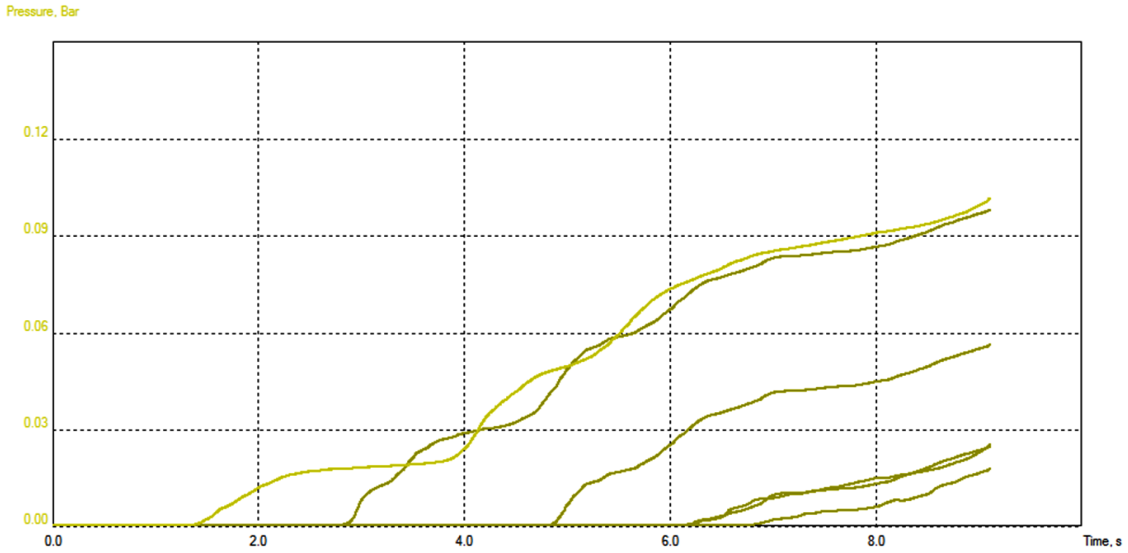


Figure 30 – The dependencies of pressure in melt from the time of the mould filling.

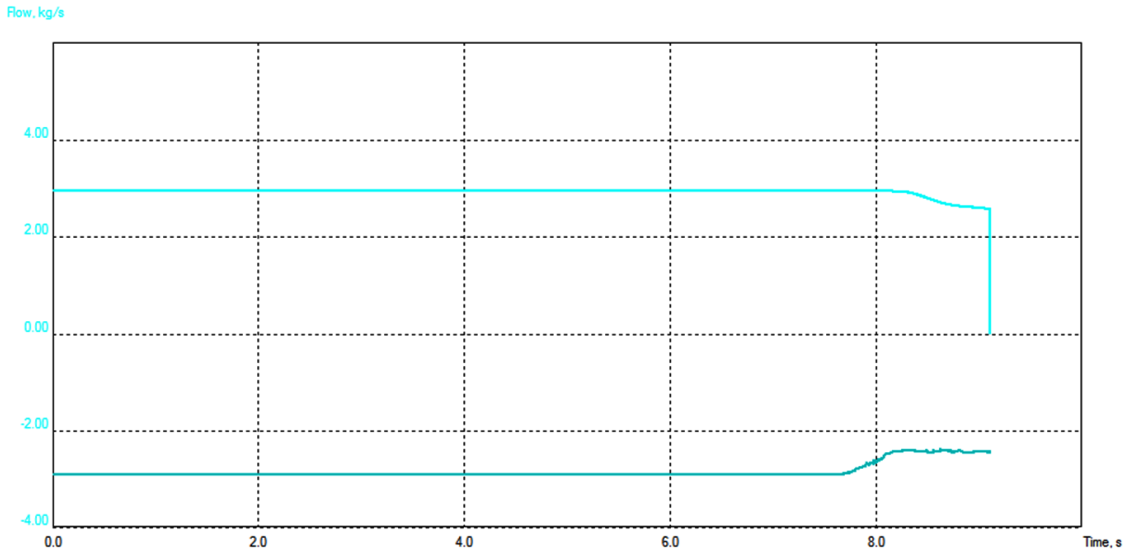


Figure 31 – The change of melt flow from the time of the mould filling.

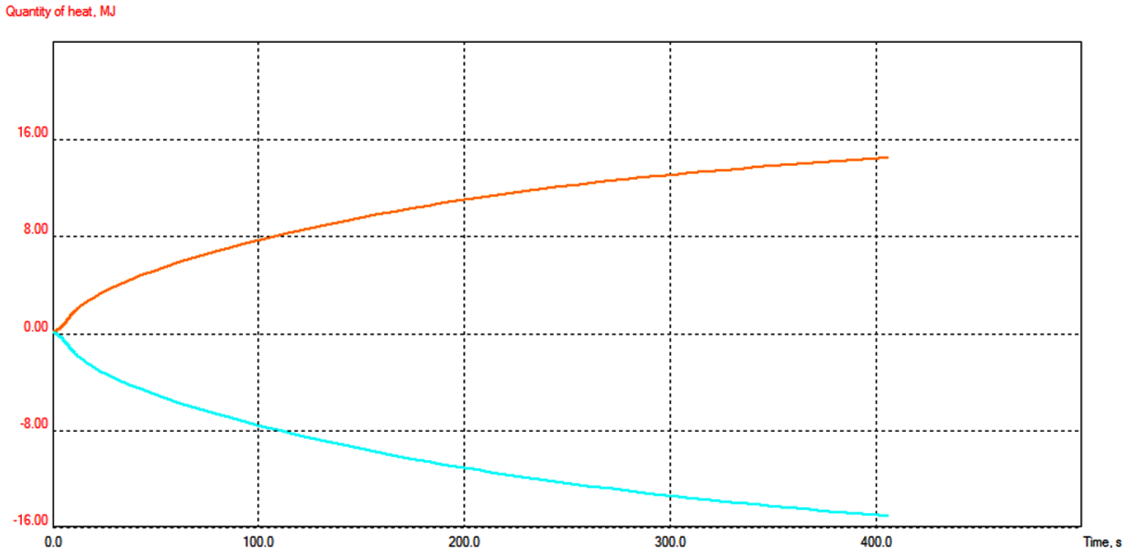


Figure 32 – The change of the quantity of heat of melt from the time of the mould filling.

The fluctuations of cooling rate of melt were determined at the stage of the mould filling. The solidification process occurs with a constant rate of cooling of the inner layers of the alloy.

On the chart of flow, the upper dependence is melt flow on the sprue, the lower dependence is melt flow on the flowmeter.

The chart of the quantity of heat determines the change of the quantity of heat in the alloy and moulding sand since the beginning of the simulation of the casting process. The colors of the dependencies correspond to the colors of the models of materials. The casting gives off heat (negative values), moulding sand takes heat (positive values). The process of heat transfer is uniform.

The general view of the casting, manufactured under production conditions, is presented in Fig. 33.

Figure 33 – The casting of frame of the terminal box.

The results of the computer simulation will be useful in the selection of the foundry equipment and the implementation of the optimization of the casting process.

Conclusion

The performed analysis of the results of the finite element simulation of the casting process of grey cast iron in the sand mould allows to draw the following conclusions:

1. The time of casting, when melt flow is 2.921 kg/s, was amounted to 405.291 s. This is approximately on 17 minutes less than exposure time of the casting in the sand mould in accordance with the basic technological process.

2. The casting in the sand mould is cooled unevenly. It leads to the formation of local residual stresses in the casting material. Such deformations are most exposed remote from the feeders layers of the material, the bottom part and the side walls of the casting.

3. Calculated volumetric shrinkage of the material exceeds acceptable shrinkage in 10 times in the bottom part of the casting. The presented calculation of the required dimensions of the feeder allows to eliminate this type of defect of the casting.

4. The formation of shrinkage porosity is characterized by cooling rate of grey cast iron (at the temperature of full crystallization). It was obtained the critical value of the Niyama criterion (N_y = 1.8), below which porosity in the casting material is formed. Probability of the formation of shrinkage porosity in more degree is occurred on two symmetric side walls and the part of the bottom surface of the casting.

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SECTION 7. Mechanics and machine construction

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PROCESSES, OCCURRED DURING DEWATERING OF MOISTURE SATURATED MATERIAL

Abstract: *In the article reviewed modern state of research and existing models of moisture-rich material, pressed between rotating rollers.*

Key words: *moisture removal, hydro-dynamics, deformation, moisture-rich material, roll mechanisms.*

Language: *Russian*

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ПРОЦЕССЫ, ПРОИСХОДЯЩИЕ ПРИ ОБЕЗВОЖИВАНИИ ВЛАГОНАСЫШЕННОГО МАТЕРИАЛА

Аннотация: *В статье рассматривается современное состояние исследований и существующие модели движения влагонасыщенного материала, зажатого между вращающимися валками.*

Ключевые слова: *удаление влаги, гидродинамика, деформация, влагонасыщенный материал, валковые механизмы.*

Introduction

Механическая технология обработки различных материалов с применением валковых механизмов широко применяются во многих отраслях промышленности. В легкой, текстильной, хлопкоочистительной, пищевой, металлургической, резиновой, химической, целлюлозно-бумажной и других отраслях промышленности, валковые механизмы являются основными рабочими органами ряда технологических оборудований [1, с. 8-9; 2, с. 3; 3, с. 47].

Materials and Methods

Впервые контактная задача взаимодействия катков или цилиндров и цилиндра с плоскостью решена Г.Герцем в статике. При решении принимались условия, что, материалы контактирующихся тел однородны и изотропны, деформации тел абсолютно упруги и подчиняются закону Гука, величина площадки контакта мала по сравнению с размерами валков. При этих условиях нормальные напряжения распределяются по поверхности контакта по эллиптическому закону. Однако, в большинстве

практических задач, связанных с обработкой валковыми парами различных материалов, принятые предпосылки при решении контактной задачи не выполняются. Материал получает не только упругую, но и пластическую деформацию, зависимость которой от напряжения имеет не линейный характер и не подчиняется закону Гука. В связи с этим, действительные закономерности распределения контактных напряжений в валковых парах с эластичными покрытиями отличаются от эллиптического закона [4, с. 241].

Основным рабочим органом валковых машин является валковая пара, контактирующаяся с обрабатываемым материалом. Технологические процессы в валковых машинах осуществляются в результате контактного взаимодействия валков с обрабатываемым материалом. Возможность интенсивного воздействия валков на материал в зоне контакта способствует повышению эффективности технологических процессов.

Научно-исследовательские работы в области валкового оборудования в основном проводились в направлении разработки методик его проектирования или совершенствования с целью создания высокопроизводительных, эффективных и экономичных машин. Они исследовались с учетом особенностей различных листовых материалов, а также процессов обработки листовых материалов с валковыми устройствами применительно к различным видам оборудования [5, с. 48; 6, с.3; 7, с. 6].

Для выбора оптимальных параметров проектируемой машины необходимы расчетные формулы или готовая программа, описывающая поведение исследуемого объекта и позволяющая для любого заданного набора параметров рассчитывать проектируемую систему и вычислять все критерии качества.

При исследовании валковой пары необходимо исходить из сил, действующих на валки в процессе работы. Величина и направление действующих сил, при захвате обрабатываемого материала и в установившимся режиме различны, и они зависят от многих параметров и факторов. К этим факторам относятся: диаметры валков, которые могут быть равными или различными; кинематическая связь между валками, может быть жесткой или же один из валков свободный, который будет вращаться за счет фрикции; установка валков, которые могут быть установлены горизонтально или наклонно, один над другим с расположением их осей вращения на вертикальной или на наклонной плоскости, а также вертикально; при этом для создания прижима между валками, они могут быть подвижным верхний, нижний или оба валка; валки могут быть твердыми или упругими покрытиями, которые могут быть влагопроницаемыми или не влагопроницаемыми, в зависимости от технологии могут выбираться их комбинации. Кроме того, один из валков или оба валка могут быть составными. Валки могут быть обогреваемыми или не обогреваемыми, могут быть их комбинации. Помимо того, обрабатываемый материал на выходе из валков может подвергаться растяжению с некоторой силой или заталкиванию при захвате в валки, это имеет место для твердых материалов [2, с. 84].

Проблемы совершенствования существующих и разработки новых технологических процессов обработки материала и создания оптимальных конструкций валковых машин тесно связаны с геометрическими, кинематическими и динамическими закономерностями процесса. Эти закономерности легли в основу исследований А.П. Грудева, В.М. Клименко, А.М. Онищенко, И.Д. Кугушева, Г.А. Мюллера, Н.Е. Новикова, А. Ниссэна, Д. Свита и др. [2, с. 6].

Кинематические и динамические особенности процесса прокатки металла в различных валках достаточно хорошо изучены в предположении, что справедлив закон сухого трения Амонтона, согласно которому коэффициент трения является константой.

При исследовании движения материала, зажатого между вращающимися валками и содержащего жидкостные компоненты, существуют различные подходы. В.И. Смирновым и А.Ф.Новиковым исследовано движение продукта, зажатого между вращающимися валками, при постоянном коэффициенте трения в очаге деформации и без изменения массы рассматриваемого материалы [8, с. 15].

Г.К.Кузнецовым рассмотрена гидродинамика процесса отжима текстильных материалов с использованием изотропной и слоистой моделей, причем принято, что движение жидкости в них подчиняется закону Дарси. При пропуске между валками, под нагрузкой отжимаемый материал деформируется, отдельные его элементы сближаются, возникает гидравлическое давление, и движение жидкости. Утверждается, что движение жидкости при отжиме осуществляется за счет гидродинамического давления, возникающего в слое обрабатываемого материала, вследствие деформации его валками. Закон распределения гидродинамического давления по длине зоны деформации практически не зависит от вида и свойств отжимаемого материала [9, с. 4;10, 19].

Непосредственное использование этих теорий при изучении процесса обработки различных плоских влагосодержащих

материалов, между двумя валками дают значительную погрешность.

Значительные теоретические и прикладные разработки известны по вопросам отделки бумаги в каландрах. По теории Ниссэна в зоне контакта рабочих валков, которую он делит на две части: входную и выходную, влага из материала удаляется в выходную часть. Это объясняется тем, что удаление влаги из материала происходит под действием капиллярных сил в выходной части зоны контакта, где упругие покрытия валков при расширении впитывают влагу [11, с. 605].

Результаты других исследователей [12, с. 367], показывают обратную картину: влага удаляется из входной части зоны контакта и в выходной части, при этом имеет место впитывание влаги материалом из покрытий валков. Следует иметь в виду, что характер удаления влаги из материалов и впитывание влаги материалом покрытий валков зависит от свойств материалов и механических параметров валковой пары.

На основе уравнений фильтрации Козени-Кармана и гидростатического давления Гаскелла, разработана физическая модель процесса отжима на валковых устройствах, в основу которой положена гипотеза о том, что данный технологический процесс рассматривается как сочетание двух одновременно протекающих и взаимосвязанных механизмов, фильтрации жидкости и движения жидкой пленки по материалу. На основе анализа полученного уравнения сделан практический вывод о том, что глубина фильтрации жидкости в материале увеличивается пропорционально $\sqrt{R}$ (R – радиус валков), т.е. увеличение диаметра валковой пары способствует более полному удалению жидкости из волокнистого материала.

Для нормального протекания процессов механической обработки влагосодержащих листовых материалов, важное значение имеет содержание в нем влаги. Например, кожевенный полуфабрикат обычно после дубления и пролежки а также после красильно-жировальных процессов содержит около 70% влаги. Такое высокое содержание влаги отрицательно влияет на проведение последующих процессов, в частности строгания, двоения и сушки в наклейку. Содержание влаги в кожевенном полуфабрикате после отжима должно быть 55-60%. Низкая, менее 50% влажность кожевенного полуфабриката резко снижает эффект последующих механических операций. Складки, образовавшиеся на нем после отжима, практически не разглаживаются.

Анализ полученных результатов показал, что зависимость остаточной влажности от диаметра валков при разных давлениях различна. Установлено что при среднем удельном давлении, равном $1{,}5 \cdot 10^6$ $н/м^2$ и выше, эффект обработки с увеличением диаметра повышается. Лучшие показатели были получены при отжиме влаги из ткани шкуры валками диаметров 0,30-0,35 м.

В работе утверждается, что чем меньше диаметр рабочих валков, тем больше удельное давление сжатия листового материала между ними и, следовательно, эффективнее качество обработки.

Ряд исследований зоны контакта валковых пар был направлен на создание математических моделей процессов. Анализ работы оборудования показывает, что только повышение скорости его работы как источник повышения производительности оборудования и труда в основном себя исчерпал. Акцент поиска резервов роста производительности труда, сейчас сместился в область механизации и автоматизации ручных и вспомогательных операций.

Определению влияния диаметров валков на эффективность обработки и определению его параметров посвящено много работ, так как диаметр валков определяет геометрию зоны контакта. Результаты исследований о влиянии диаметров рабочих валков на остаточную важность весьма противоречивы. От диаметра валков зависит ширина зоны контакта, время обработки, условия захвата и втягивания материала и соответственно качество его обработки, остаточная важность материала и др. [13, с. 231; 14, с. 119]

На основании экспериментальных исследований В.А.Кузнецовым [15, с. 15] создана математическая регрессионная модель валкового отжима, связывающая факторы: давление, диаметры валков, скорость ткани и остаточную влажность. Предложенная модель позволяет рассчитать эффект обезвоживания и основные параметры валкового модуля. Установлено, что зависимость изменения толщины ткани от давления идентична для всего исследованного ассортимента и характеризуется наибольшим изменением толщины в диапазоне давлений до 15 МПа, относительная деформация тканей при этом составляет 56-72%. Дальнейшее увеличение давления до 25 МПа способствует изменению относительной деформации всего на 2-4%, также, увеличение скорости движения ткани с 2,5 до 4,2 м/с ухудшает отжимной эффект на 10%. На основании исследований, автор делает вывод, что для интенсификации отжима ткани необходимо увеличить нагрузку и уменьшить диаметры валков. Для обеспечения усиленного отжима ткани оптимальным является диаметр рабочих валков 0,21-0,25 м при нагрузке 30-50 кН/м.

Технический уровнь валковых модулей текстильного отделочного производства повышается путем создания качественно новых методик проектирования, учитывающих конструктивные особенности валков, характеристики обрабатываемого материала и параметры технологического процесса обработки ткани. На основе силового анализа валкового модуля разработан алгоритм их расчета. Установлено, что между сближением валков и интенсивностью нагрузки в зоне контакта существует нелинейная зависимость, характер которой зависит от радиусов взаимодействующих валков, толщины и модуля упругости первого рода эластичного покрытия.

Г.К.Кузнецовым и рядом автором [7, с. 6, 9, с. 13] выполнены исследования в области механики валковых механизмов. Выявлены силовые режимы работы этих механизмов для нескольких схем кинематического взаимодействия валков и обрабатываемого материала, изложены вопросы теории распределения напряжений по поверхности контактов валков при различной степени податливости покрытий. Силовой анализ валковых механизмов с учетом стационарности их работы уравновешенности звеньев проводился статистическими методами и заключался в определении главного вектора и главного момента нормальных и касательных сил. Нормальные и касательные напряжения распределяются вдоль дуги контакта в соответствии с закономерностями, которые определяются схемой действия сил, упругими и фрикционными свойствами обрабатываемого материала и покрытия валков. Рассмотрены варианты возможных законов распределения нормальных напряжений: эллиптический, параболический, гармонический и показательный. Установлено, что распределение нормальных и касательных напряжений для зоны контакта валковой пары в динамике отличается от статического и становится несимметричным.

Также Г.К.Кузнецов [9, с. 56] установил, что касательные контактные напряжения при статическом контакте и при вращении с незначительным моментом сопротивления на ведомом валке, меняет знак при переходе через осевую плоскость валков. Абсолютные величины напряжений практически симметричны относительно этой плоскости. Также рассмотрены переходные процессы, возникающие при прокатке валковой парой неравномерного слоя материала. Установлено, что нагрузки, действующие на прокатываемый материал, при больших скоростях возрастают. В результате большого объема исследований Г.К.Кузнецовым разработана методика проектирования валковых устройств текстильных машин и предложена их классификация, позволяющая систематизировать исследования в области механики валковых машин и методов расчета их рабочих органов.

Экспериментально исследовано влияние покрытий рабочих валков на эффективность удаления влаги и установлено, что при прочих равных условиях применение нежестких покрытий снижает эффект обработки, но сохраняет физико-механические свойства волокон материала. Это объясняется увеличением размера площадки контактов валков и снижением удельного давления на материал.

В настоящее время величина нагрузки на валки устанавливается на основании экспериментальных данных из-за отсутствия современных методов их расчета. Совершенствуя методы расчета вытяжных механизмов для мокрого прядения льна В.В.Фарукшин [16, с. 16] рекомендует определение нагрузки на нажимной валик с использованием дискретной модели силового взаимодействия элементов выпускной пары. При условии, что нагрузка вдоль образующей валка распределяется равномерно, задаваясь законом распределения интенсивности нагрузки вдоль оси нажимного валка и проверяя выполнение условий силового взаимодействия элементов выпускной пары, полученных автором, можно найти необходимую нагрузку на валок.

На основе гипотезы о нерастяжимости контактирующей поверхности, без учета влияния обрабатываемого материала К.Д.Буданов [17, с. 154], проводил силовой анализ эластичных покрытий валковой пары. Им получены упругие характеристики грузовиков тканепечатных машин в виде степенной функции, основные показатели процесса печати; максимальное и среднее давление в контактной полосе, исследован процесс скольжения печатных валков по грузовику.

Лодойн Удвал [18, с. 162] исследуя процесс транспортировки тканей валковыми модулями, установил, что относительная деформация покрытия валков модуля по длине дуги их контакта изменяется по параболическому закону. Динамическая нагрузка от шва на валок пропорциональна его массе, квадрату скорости движения ткани и зависит от параметров швов. Для снижения динамических нагрузок при прохождении швов рекомендуется снижение массы валков и в трех валковых модулях рекомендуется применение систем валковых модулей с двумя степенями свободы перемещения.

В технологии механической обработки различных материалов отжим влаги из влагосодержащего материала играет важную роль. Которая выполняется преимущественно на валичных машинах. Особенности процесса

валичного отжима изучены недостаточно [19, с. 15].

Непосредственное использование вышеперечисленных теорий при изучении процесса отжима влагосодержащего материала между двумя валками дают значительную погрешность. Она возникает, в частности, из-за того, что закон сухого трения Амонтона здесь не применим, т.к. при отжиме влагосодержащего материала приходится учитывать его способность прилипания к поверхностям валков в зависимости от содержания в ней влаги. В результате при наличии двух валков коэффициенты трения будут зависеть также от продольной координаты в очаге деформации.

Механическое обезвоживание материала в промышленности экономически целесообразно, так как гораздо дешевле сушки. Но механическое обезвоживание не беспредельно. Какие бы совершенные конструкции не создавались, снизить влагосодержание материала механическим путём ниже определенного предела, зависящего от ряда факторов, невозможно.

Таким образом, научные основы движения влагонасыщенного упругопластического тела переменной массы между вращающимися цилиндрами имеющими упругие оболочки полностью не решены.

Чтобы полнее определить возможность отжимных машин, вкратце рассмотрим явления влагопоглощения и соответственно влагоотдачи материала.

Влагосодержащие материалы, используемых промышленностью, достаточно велико. Они отличаются друг от друга не только по своей структуре и химическому составу, но способности поглощать воду.

При погружении пористого материала в жидкость она в большой или меньшей степени увеличивается в своем объеме, что и является набуханием, степень которого изменяется количеством жидкости, поглощенный единичном объеме материала. Этот процесс идет до некоторого предела и зависит от температуры, с повышением которой скорость набухания растет, но абсолютная величина его понижается. Через определенное время замачивание достигается предельный объем набухания. Количество поглощенной жидкости зависит от вида и свойств материала. Некоторые естественные материалы являются гидрофильными, т.е. молекулы воды испытывают притяжение к ним и обладают способностью смачивать его.

Таким образом, чем выше способность материала к набуханию, тем больше она поглощает влаги.

Неодинаковая способность материала к адсорбции предопределяет и различную их влагоотдачу при отжиме. В материалах после их смачивания содержится влага трех видов: свободная (поверхностно – обволакивающая), капиллярная и адсорбционная (влага набухания).

При обезвоживании влагосодержащего материала происходят следующие физические процессы. В первый период отжима удаляется поверхностно – обволакивающая влага, удерживаемая на поверхности материала или в ее порах. Затем удаляется капиллярная влага сначала из грубых капилляров, потом из мелких ультрапор. При дальнейшем обезвоживании остается лишь адсорбированная вода.

При исследовании влагоотдачи влагосодержащего материала было замечено, что сначала отдача воды идет довольно быстро, а затем, когда остается небольшое количество влаги, обезвоживание сильно замедляется.

Представим общий объем влагосодержащего материала V равным сумме:

$$V=V_n+V_k,$$

где V_n – объем пор;
V_k – объем занимаемый частицами материала.

Введем также обозначения:
Q_k – масса материала;
Q_n – масса воды в порах.

Абсолютная влажность материала материала

$$W=\frac{Q_n}{Q_k}100\%.$$

Обменная масса материала

$$\gamma_k=\frac{Q_k}{V_k}\left[кг/_{м^3}\right]$$

Пористость $n=\frac{V_n}{V_k}$.

Влагопроводность в процесс отжима не остается величиной неизменной, так как при сжатии прессуемой массы материала объем пор сокращается и резко меняется сопротивление движению жидкости. Величина n, характеризующая пористость материала, представляет собой отношение объема полостей, приходящихся на пустоты, занятие жидкостью, к объему сухой массы материала. Очевидно, что

$$n=f\left(P_T\right),$$

где P_T – часть внешнего давления, воспринимаемая влагосодержащим материалом.

При повышении давления масса влагосодержащего материала сжимается и пористость его снижается. Мерой способности деформироваться является отношение

$$a=-\frac{dn}{dp},$$

причем для различных влагосодержащего материала величина «a» будет различна.

Conclusion

Итак, влагопроводность и пористость зависят от давления. И та и другая величины с повышением давления снижаются. Но этот процесс не бесконечен. Существует такое предельное значение давления, при котором пористость уже не изменяется, а материал становится практически водонепроницаемым.

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LIBRARY DEVELOPMENT FOR CREATING BOTS ON SLACK, TELEGRAM AND FACEBOOK MESSENGERS

Abstract: *Article contains analyze of existing libraries for messenger bot creation. Also this article describes creation of library that take into consideration advantages and disadvantages of existing solutions.*

Key words: *Bot, library, software development, Java, Telegram, Facebook, Slack, messenger.*

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Introduction

In nowadays more and more people are using messengers. Messenger is a desktop, web, or mobile application for communication over the internet. It must be said that the concept of communication over the internet does not imply only text messaging. Modern messengers in addition to messaging implement voice and video, file sharing, web conferencing. [1]

Today companies are paying special attention to instant messengers, which are becoming serious competitors to other mobile applications. This is facilitated by chatbots - conversational-program, which are already near to become full-fledged interlocutors and assistants. They help to learn a news, exchange rates, order goods, pick up a suitable flight, music, book, and even can act as a distance teacher.

Motivation

The purpose of this work is to develop a library that will allow developers to create bots for instant messengers such as Slack, Facebook Messenger, Telegram in Java.

There is a large number of users that have difficulties installing a set of mobile applications for every company. Analyzing this situation, many companies come to the conclusion that such users are more likely to use one messenger with several chatbots that replace multiple applications. Because each person uses what is more suitable for him, companies need to support as many platforms as possible, thereby increase the number of clients. Therefore, it would be simpler to be able to communicate with users on multiple platforms without developing for each platform. Hence, there is a demand for existing libraries for fast and simple chatbots development. Therefore, the main task for us was the creation of the library that supports Slack, Facebook Messenger, Telegram platforms. [8]

Implementation

Chat bots can be developed in any programming language with which you can create a web API. The back-end receives the message, thinks what to answer, and returns the response to the user.

For the library that must run on multiple platforms, we need to choose appropriate language. Java is one of most popular language that can run on a huge number platforms. (By Tiobe, PyPl and IEEE Spectrum)

API (application programming interface) is set of classes, procedures, functions, structures and constant provided by application, library, service or operation system for use in external software. In this case, the API is provided to developers in the public domain.

Your web server will install so-called webhooks - URL-based connections between your bot and the chat platform. There are two mutually exclusive ways of receiving updates for bot — the getUpdates method on one hand and Webhooks on the other. Incoming updates are stored on the server until the bot receives them either way, but they will not be kept longer than 24 hours. Webhooks will allow you to safely send and receive messages through simple HTTP requests. [5, 6]

Our library will allow developers to call Java methods to send and receive data from messengers.

```
@Override
public void sendMessage(Message message) {
    SendMessage libraryMessage = new SendMessage();
    libraryMessage.setChatId(message.getChat().id);
    if (message.getType() == MessageType.TEXT_MESSAGE) {
        libraryMessage.setText(((TextMessage)message).text);
    }
    try {
        sendMessage(libraryMessage);
    } catch (TelegramApiException e) {
        e.printStackTrace();
    }
}
```

Figure 1 - Sending message demonstration.

Platforms features

Each platform has its own individual characteristics and features, which must be taken into account. Examples of features:

1. Telegram support new types of input, keyboards that integrated into a message.

Unlike the regular keyboard, clicking on the button of the integrated keyboard will not send messages to the bot - instead, the data will be transferred in the background, which mirrors the interaction with a normal application. [2]

2. Facebook messages can be either just text or Structured Text, which are divided into:

- button:

This type is used to send messages, which require user response.

Buttons can be one of two types:

- Sending response to bot;
- Redirecting to internet address;

- generic:

Elements are intended to send cards of goods or other items having a similar structure.

Each member may have title, subtitle, description, image and buttons.

- receipt:

A receipt may contain information about goods, cost, delivery address, discounts. [3]

3. Slack allows you to use additional types of keyboards and mark individual user messages. [4]

Overview of existing libraries

Already exist a sufficient number of libraries that implement the integration of messenger APIs to create bots on various programming languages. But we did not find any that would unite these popular platforms in one, with full functionality, and would be implemented in the Java language. (Table 1)

Table 1

Compare existing and existing libraries.

Libraries			
Our library	*BotKit*	*Claudia Bot Builder*	*Universal Bot Framework*
Programming languages			
Java	Java-Script	Java-Script	JavaScript
Supported systems			
Slack, Face-book Mes-senger, Tele-gram	Slack, Face-book Mes-senger, Twilio, Micro-soft Bot Frame-work	Facebook Mes-senger, Slack, Skype, Viber, Telegram, Twilio, Amazon Alexa, Line, Kik, GroupMe	Facebook Messenger,Telegram, Kik, Skype
Targeted			
Develo-pers	Deve-lopers and ordi-nary users	Develo-pers	Developers
Объединение интерфейсов			
Full support	Full support	No support for additional features	No support for additional features
Full functionality support			
Full support	Full support	Full support	No support for additional features.

It should be noted that in this table there is no comparison with open-source projects that implement the work in the java language separately for single platforms. Since they have a different task.

Testing

After the library was implemented, testing was performed on supported platforms. (Fig.2) For the tests, it was decided to create a bot that audits user actions in the PostgreSQL DBMS using created library [7].

The server was implemented through the Open Server with the PostgreSQL module. To work directly with the DBMS was used PgAdmin. [9]

The test bot responds to commands entered by the user.

After starting the bot, it connects to the server log file and starts tracking changes. Once a new entry is added to the log file and the administrator enters command the bot immediately send the message with event description.

With the command "/find_action" you can tell the bot what events you want to find in logs. For example, the command "/find_action select" tells the bot to send data about the select requests being executed.

For example "/find_composite user1 select" - will output of select operations performed by a specific user (user1).

Also, it is possible to receive error notifications. Displaying of the necessary errors occurs through the command "/find_warning".

If you need to use a different log location you can specify it using the command "/setlog" followed by the path to the server. The path can be specified in Windows style (with backslashes) and in Unix style (with regular slashes). The path will be converted to the paths on which OS the PostgreSQL server is located. Also, the "/find" command is available for the database administrator, which is an extremely flexible way of finding specific records in the log. As arguments in this command you can use time intervals, types of records (select, insert, start, stop, etc.), the duration of the action. In the further development, additional opportunities will be added to this search.

With the development of the library, the bot will get a more user-friendly interface using buttons and lists.

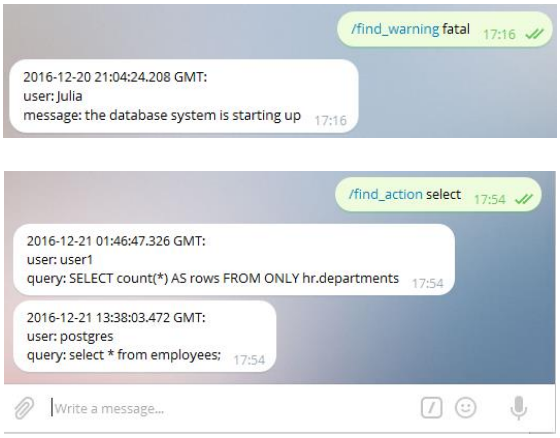

Figure 2 - Demonstration the work one of the test bots on the Telegram platform.

Practical significance

Created library is aimed at developers, who need frequent dispatches for messengers various platforms. Because, using the library, they have the opportunity not to create a separate program for each platform, but make the dispatch immediately to selected platforms, through several lines of code.

Companies that need such mailing fair amount, reiterate the importance of the development using this or similar libraries.

Conclusion

A ready-to-use Java library was created. This library allows developers create bots within the unified system for Slack, Telegram and Facebook platforms. In the future, it is planned to add new platforms, as well as to facilitate development by adding auxiliary design patterns for bots.

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SECTION 26. Radio-technique. Electronics. Telecommunications.

THE BASIC CONCEPTS ABOUT LIGHT AND ITS PRACTICAL APPLICATION IN FILMING

Abstract: *The article resents the basic concepts and methodologies of practical application of light in filming. The main attention is paid to the data on the values of the ranges of visible spectrums, terminology, and also units of measurement. Examples for calculating the lighting during the filming are given.*

Key words: *light, spectrum, lighting, Weber-Fechner law, filming*

Language: *English*

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I. Introduction

Correctly selected lighting allows to fully convey the emotional character of the scene, aspects of the characters in action, their environment. Due to the lighting we perceive space and objects as three dimensional on a flat screen. Specialists who ensure illumination for filming the video and television, play an important role as an audio operator in the preparation of radio programs, since it is their skill that determines the quality of the image.

The artistic expressiveness of video production (especially in HDTV/DTV technologies) and films that shot on film is considerably determined by the creative attitude to the formulation of lighting. In order to learn correctly control the light, knowing its main characteristics, quality, color temperature and light intensity is needed**.**

In lighting on television, in the cinema or in the theatre, one should consider how people see changes in brightness on the scene, which is called the logarithmic law of perception of the image by our eye and brain, conditioned by nature itself.

II. Main part

According to the Weber-Fechner law, the intensity of the sensation is proportional to the logarithm of stimulus intensity, in most cases the human perception of brightness occurs logarithmically; for example, changes in the pitch of the sound tone, in the volume level, and also changes in the brightness of the subjects are estimated in this way [1].

This means that a logarithmic change, or a logarithmic progression, occurs when each subsequent number in a series of numbers is a multiple of the previous number.

Returning to the human perception, it should be noted that our eye and brain have a different sensitivity to changes in the level of influence (from areas with different brightness). They are more sensitive to changes in a weakly lighted scene than in a brightly lighted one. Another way to deal with this issue is to evaluate this phenomenon with reference to the conditions for the reproduction of brightness in a television process. The control and management of the level of black, which is installed on the camera, are arranged in such way that they are extremely sensitive to setup, and even a small error in the video signal level will result in either too dark images, with "**notches**" in the shadows, or with "**thin**", low-saturated images without black tones. While at the white level, in the peaks of the television dynamic range, the same percentage change in the signal level will not have a noticeable effect on the tonality of the image.

Whenever trying to evaluate the uniformity of lighting, it is easier to use a "**monochrome**" glass with a transmittance coefficient of 1%, which is an optical filter for viewing, as it were, "**compressing the maximum brightness**", which are visible to the eye, so that in the scene

it can be seen with a significant decrease in its brightness. In this case, the differences in brightness between light and dark objects will be seen most clearly.

The purpose of logarithmic control over exposure is that when the aperture of the lens opens or closes on f-stop values, the brightness of the image will **change equally** between the two neighboring values of an aperture, i.e., this will create the same increment when perceiving such image. The increase in brightness of the image in logarithmic dependence is used in the tables of gray scales, which are used to adjust the television path. For our eye and brain, to see changes in the brightness of adjacent gray fields in equal amounts of increments, the changes in the reflection coefficients of these fields must follow the logarithmic law.

Light is a part of the spectrum of electromagnetic oscillations, inclusively to microwaves and radio waves, which limits the visible spectrum of waves on the right. Figure 1 illustrates the state of the visible part of the spectrum within the full electromagnetic spectrum and its color, perceived differentially by our vision, depending on the wavelength of the radiation.

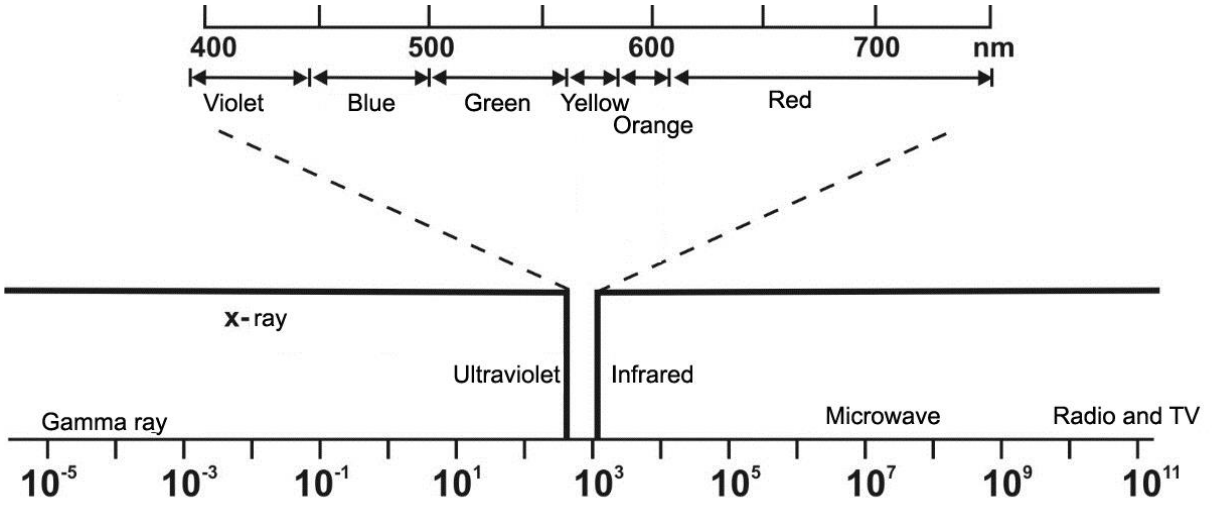

Figure 1 - State of the visible spectrum.

Light is usually characterized by a wavelength (do not confuse with frequency) and expressed in nanometers (nm), where 1 nm = 10^{-9}m. The visible spectrum ranges from about 400 nm (blue) to about 700 nm (red). The reaction of the human eye and brain is inhomogeneous, falling to any direction from the maximum sensitivity at a wavelength of 555 nm.

The average response of the eye and brain is called the photopic curve (or the visibility curve) (Figure 2). It is important that any measurements of light are consistent with the way we see, that is, all instruments that measure lighting should have a corresponding photopic characteristic [2].

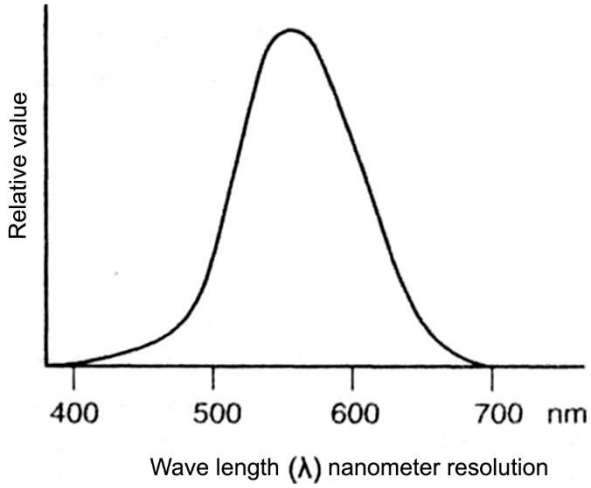

Figure 2 - Visibility curve – average value of eye reaction to the light.

Light units are based on comparison with the visual standard. Figure 3 illustrates the various lighting parameters that we must and can measure.

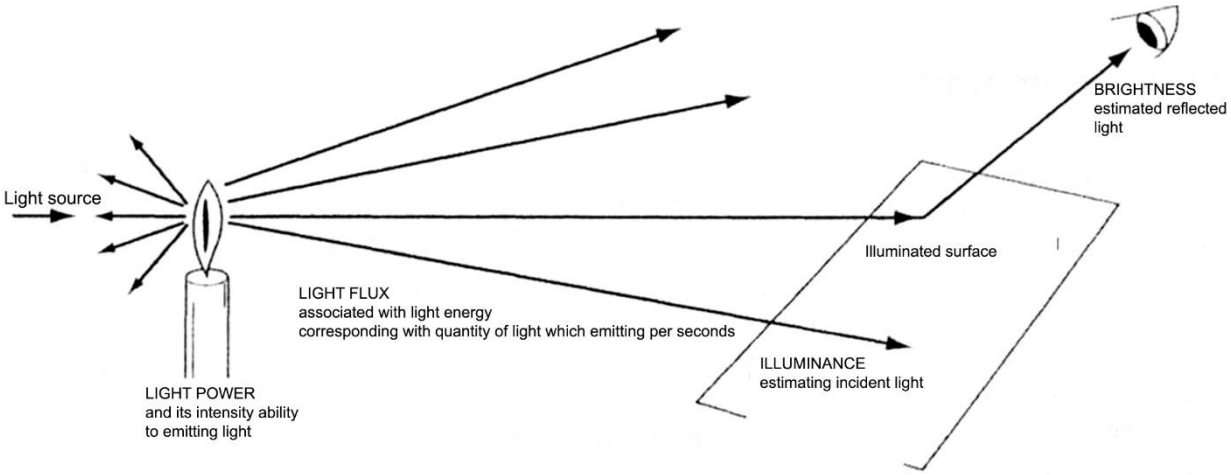

Figure 3 - Light. Estimated parameters.

Luminous intensity (*I*) - evaluates the source's ability to emit light, expressed in candela (formerly called candlepower).

Luminous flux (*F*) - estimates the light energy emitted by the source in every second, expressed in lumens.

Illuminance (*E*) - estimates the light energy falling on the surface, expressed in lux ($\frac{lumen}{m^2}$) or $\frac{foot}{candela}$ - ($\frac{lumen}{ft^2}$).

Luminance (*L*) - estimates the light energy reflected from the surface, expressed in apostilb (reflected $\frac{lumen}{m^2}$) or foot/lambert (reflected $\frac{lumen}{ft^2}$).

Note. There is a term - "brightness", which refers to how brightly we see the objects. This is a subjective effect that depends on the environment and the background. Our eyes and brain adapt to the prevalent visual lighting conditions. In everyday practice, the term "brightness" is often used when the term "luminance" has to be used.

In the dictionary, the term "luminance" is translated into russian in the same way as the term "brightness" [3]. In the SI system, the brightness is estimated in $\frac{cd}{m^2}$ [4-10].

Light intensity (I). This is the estimation of light energy based on a **visual** comparison with known standard sources. Originally it was a standard candle, which was called the ***candlepower***. For example, the light intensity of 15,000 candles has a 1-kilowatt spotlight with a Fresnel lens in the operating mode. Subsequently, in the international SI system, the candlepower standard was replaced by a modern candela standard, which is scientifically a more precisely established standard. However, for practical purposes, the terms candlepower and candela can be evaluated as similar.

Light flux (F). This is an estimate of the light energy, expressed in lumens and can be determined, as shown in Figure 4. This is the amount of light energy emitted per unit solid angle from a point source by the light intensity into one candle. Clearly, an element of time should be introduced here, and in this case the definition will be: a light flux is the amount of light energy emitted every second in a unit solid angle from a point source by the light intensity into one candela. The light flux is the energy seen by the human eye, that is, its magnitude is determined through the visibility curve (photopic curve).

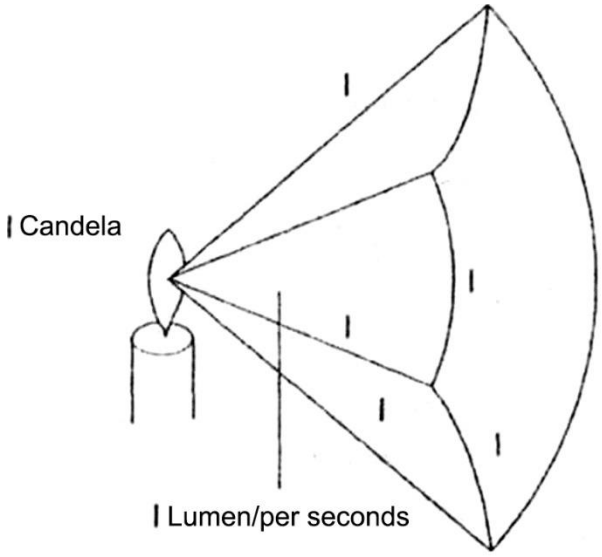

Figure 4 - Light flow is determined in lumens.

Illumination. This is a measure of the light flux falling to the surface, measured in lumens per unit area, that is, in $\frac{lumen}{m^2}$ or $\frac{lumen}{ft^2}$ (see Table 1). Figure 5 illustrates the relationship of basic units.

Table 1

Typical values of illuminance

	Illuminance, ***lx.***
Sun light with bright sunny day. Cloudless	100 000
Day light. Cloudy	6500 (2000-10 000)
Day light. Cloudy. Winter	500
Interior with natural lighting. Day	400
Interior with artificial lighting.	200-300
Illuminance of an office (horizontal side of the table)	300-500
Office with computer	300
Drawing department	750
Typical Supermarket	600-700
Sunrise/Sunset	<200
Street lighting	4-20
Moon light in full moon position	0,1

Lux - is the most preferable term for the world television (except for the US), but the term foot-candela has been in use since the very first filming and is still used by many cinematographers.

As a result, many light meters that measure falling light are calibrated in foot-candelas.

Ratio of units: To convert foot-candelas into lux, multiply the numerical value of foot-candelas by 10.76, that is, 1 foot-candela = 10.76 lux (10.76 is the number of square foots in square meters).

For most practical purposes, it is quite simple: the original number must be multiplied by 10 (when converting foot-candelas into lux) or divided by 10 (when converting lux into foot-candelas).

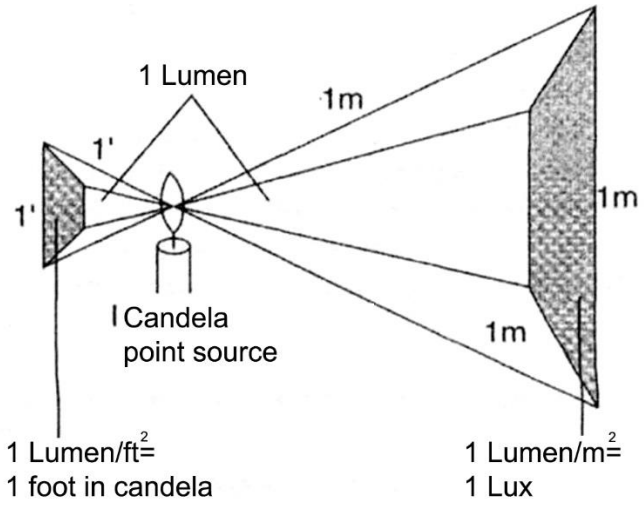

Figure 5 - Determining the units of illuminance.

Exponometers, measuring falling light usually have a very wide coverage angle. To measure the illumination, it is necessary to put a diffusion disk (lumidisk) on the photocell. However, it is more common to use a diffuse hemisphere mounted on the photoexponometer before the photocell. This hemisphere integrates all the light that illuminates the subject, and gives a better result than the lumidisk when measuring the total light on the subject.

Brightness (L). This is a measure of light energy, estimates the amount of light reflected from the surface. When the surface reflects the total light flux of 1 $\frac{lumen}{m^2}$, it is said that this surface has a brightness of 1 apostilb. (Similarly, if the surface reflects the total light flux of 1 $\frac{lumen}{ft^2}$, then it is about the brightness in 1 foot-lambert). These terms are not generally accepted, and therefore the brightness on the sienna is ultimately "measured" by the television camera.

The amount of light reflected from the surface depends on the coefficient of its reflection or on its reflectivity.

$$Brightness = (\rho \cdot illuminance) = apostilb.$$

For example, if the illuminance is 600 lux, then what is the brightness of the peak for the TV white surface with c = 0.6 (60% reflectivity)?

$$Brightness = (\rho \cdot illuminance) = 0.6 \cdot 100\, apostilb.$$

The brightness meters have very narrow measuring angles, usually 1^0, for example, such as the "Pentax" spot meter or "Minolta". Most spot meters are calibrated in exposure values (EV), where the exposure value increases by one value when the brightness is doubled. Often the exposure numbers are expressed in terms of f-stop. For example, if the peak white indicates 9 EV and black indicates 4 EV (see Table 2), then this is the contrast in 5 EV or 5 f-stops, or the contrast between these surfaces is 2^5:1 = 32:1.

The ratio of units: *1 apostilb = 0.318 cd / m^2; 1 cd / m^2 = 3.14 apostilb; 1 foot-lambert = 10.76 apostilb; 1 apostilb = 0.0929 foot-lambert.*

Table 2

Typical EV (Expositional values)

	EV
Blue	13-14
White clouds	15-16
Continuous cloudiness	10-11
Typical tone of the face in sunny day (Caucasian skin)	14-15
Typical tone of the face in overcast day	8-9
Typical tone of the face in the room (day)	7
Typical tone of the face in the room (artificial light)	6
TV monitor peak	7,0

Inverse square law. The light from the point source will be distributed by a divergent beam of rays, and consequently, the farther from the light source, the larger the area will be illuminated (Fig. 6), and the illuminance level will correspondingly decrease.

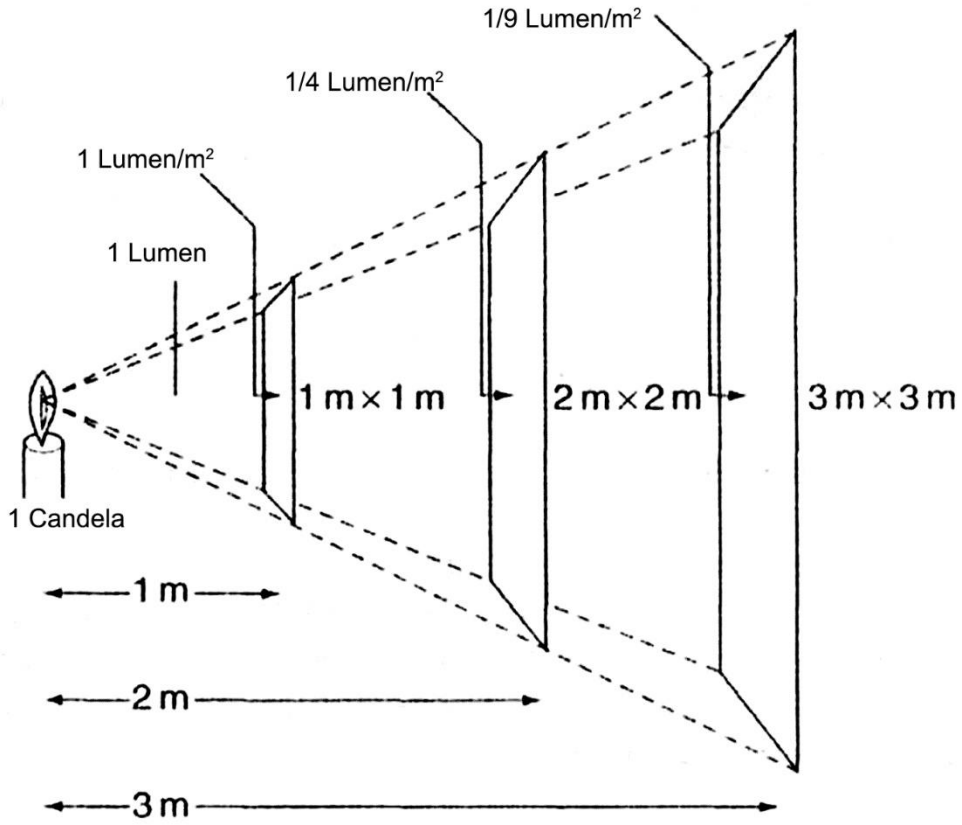

Figure 6 - Inverse square law.

In 1 m distance from the light source with 1 lumen it creates 1 lux illuminance on $1m^2$ surface. In 2 m from the light source this light flux creates the ¼ lux illuminance on the $4m^2$ surface. In 3 m from the light source it creates 1/9 illuminance on $9m^2$.

When the distance is doubled the illuminance does not decrease for ½ lux, it decreases for ¼, just illuminance decreases proportionally $(1/2)^2$.

$$Illuminance(E)\alpha\frac{1}{distance^2}lux.$$

When the distance is tripled, then illuminance decreases not for 1/3 times, it decreases for 1/9 times, or $(1/3)^2$. If light intensity is doubled then the illuminance will also be doubled. Similarly, if we had a light source of 1000 candelas, then the illuminance would be x1000. Therefore the general equation for the values of illuminance will be:

$$Illuminance(E)=\frac{Light\,intesity}{distance^2}lux.$$

Example:

1) What illuminance will be at a distance of 5 m from a 1.2-kilowatt HMI=spotlight with a Fresnel lens with a light intensity of 50,000 candelas?

$$Illuminance(E)=\frac{light\,intensity}{distance^2}=\frac{50\,000}{5^2}=2\,000\,lux$$

2) What kind of illuminance will be from a 650-watt spotlight with a Fresnel lens with a light intensity of 9000 candelas at a distance of 3 m?

$$Illuminance(E)=\frac{light\,intensity}{distance^2}=\frac{9000}{3^2}=1000\,lux$$

3) What is the maximum distance to install a 5-kilowatt spotlight with a Fresnel lens of 100,000 candelas, if it is necessary to get an illuminance of 500 lux?

$$Illuminance(E) = \frac{candela}{distance^2}$$

Thus,

$$Distance^2 = \frac{candela}{Illuminance(E)} = \frac{100\ 000}{500} = 200$$

Distance = $\sqrt{200} = 14{,}14$ m, i.e. about 14 metres.

These examples illustrate how easy to determine illumination at any distance if the effective luminous intensity is known (the effective luminous intensity usually refers to the central ray).

.

III. Conclusion

Thus, in this article we have considered the basic concepts of light, the representation of light flows and units of measurement. The main laws influencing the lighting during the filming, including light intensity and distance based on the law of inverse squares, were presented. Versions of application of light in the filming are reflected in the corresponding illustrations. Also a number of examples are given how easy it is to determine the illumination at any distance if the effective luminous intensity is known.

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SECTION 31. Economic research, finance, innovation, risk management.

SYSTEMATIZATION OF CRITERIA CLARIFYING EFFECTIVENESS OF INNOVATIVE MARKETING PRACTICES IN THE SYSTEM OF ROAD TRANSPORT

Abstract: *This article is dedicated to apply methodological approach related to the criteria clarifying effectiveness of innovative marketing practices in the system of road transport. The main reason of investigating the measures which associated with effectiveness of innovative marketing practices in road transport system is to select effectiveness indicators and apply them into practice. Research results enable criteria related to effectiveness of innovative marketing practices in the system of road transport and its evaluation steps to be applied into practice, provide an opportunity to use methodologies of finding effectiveness of innovative marketing practices as well as helps to make decisions in innovative development.*

Key words: *innovation, criteria, effectiveness, innovative marketing, effectiveness of innovative marketing, effectiveness of innovative marketing in the system of road transport.*

Language: *English*

Citation: Kakhkharov AJ (2017) SYSTEMATIZATION OF CRITERIA CLARIFYING EFFECTIVENESS OF INNOVATIVE MARKETING PRACTICES IN THE SYSTEM OF ROAD TRANSPORT. ISJ Theoretical & Applied Science, 06 (50): 70-73.

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INTRODUCTION

It is true that in this contemporary conditions of marketing reformations methodological basics play crucial role in implementing deep modifications, consolidating financial situation of manufacturing and service organizations and evaluating effectiveness of product quality and volume as well as the policy of innovation and investment. Nowadays we can see an inadequacy of methodological base in establishment and monitoring, as well as evaluation and assessment of marketing activities of automobile industry system. Especially we can consider that in the market of automobile industry service it is impossible to achieve potential outcomes in efficient development of marketing activities without applying certain methods for evaluating its effectiveness.

IMPORTANCE OF THE TOPIC

Apparently,today there are several disproportions between theory and practice. For example even though there is a need to create methodological bases of assessing the effectiveness of innovative marketing, there has been a lack of initiative to create and indicator it. For this reason, in establishing prospective long term strategic plans, first of all, it is essential to create methodological bases of assessing the effectiveness of innovative marketing or commercialization of industry services.

Thus, in any kind of organization methodological bases of assessing the effectiveness of innovative marketing requires generating aspects of its definition and the urgency of systematization of its results.

The main reason of investigating detailed criteria of effectiveness of innovative marketing activities in industry of automobiles consists of choosing indicators underlying and measuring effectiveness and applying them in evaluation process.

Relying on the objective of this research special criteria is chosen in assessing the effectiveness of innovative marketing .These criteria play important role in shaping the provision of contemporary methodological basics in evaluating effectiveness of innovative marketing in the system of automobile industries.

LITERATURE REVIEW

Nowadays research works of foreign scientists related to showing criteria regarding the effectiveness of innovations as well as innovative marketing practices and creating assessment methods, are of high importance.

Generally speaking, special researches of Michael Porter play important role in the areas associated with choosing any kind of activity in business, from the source of raw materials to analyzing and valuation of a chain of activities such as creating innovative product, its pricing and delivering it to final customer [1].

According to T. Ambler marketing effectiveness of an organization encompasses three components. First one is to evaluate effectiveness of marketing in increasing the diversity of products for developing the entity and increasing the profit holding the market share upwards.

Second component consists of the process of evaluating effectiveness in the case of functional marketing. In this case the purpose is to acquire different marketing-mix results by applying various innovative technologies in moving any kind of product. Third one deals with evaluation of different expenses allocated for marketing practices such as the measurements related to marketing budget. For the expenditures incurred for production of innovative product or service the "marketing budget" office which is contained in management and financial expenses department of the organization takes the responsibility [2].

In modern scientific literatures there is different perspective to be applied in evaluating effectiveness of innovative practices [3]:

- the position of evaluating investment effectiveness of innovative practices
- evaluation position of investment efficiencies according to acquiring results
-Evaluation process of implementation of innovative practices in each phase and different directions and others.

According to the researches of A. Barisheva effectiveness of innovative practices are evaluated according to their economical and scientific criteria [4]. In addition, C. Dedkov [5] indicates that effectiveness of innovative practices are assessed by the results of scientific and social effectiveness. Medinskiy [6] believe that it would be correct to relate effectiveness of innovative practice with effectiveness all phases utilized in innovative activities.

German scientists I.V.Babin and Y.A.Mellers notified that in evaluating effectiveness of innovative practices ,first of all, criteria in commercialization and producing innovative products should be systemized and measurements related to successful commercialization movement should be evaluated. In this case methodological bases of assessing the effectiveness of innovative marketing is mentioned and other effectiveness measurement criteria ranging from economic, financial, social resources to ecologic and collaborative scientific-technological are investigated [3].

There are several scientists who have done a range of researches in evaluating effectiveness of commercialization and creating innovative products. For example, A.A. Stepano, I.Yu.Evgrafova, Ya. Sobon, M. Rogozinsk and other scientists have taken investigation of innovative marketing effectiveness into consideration in their research works.

Some of the scientist in Uzbekistan in the sphere of economics such as SH.N. Zaynutdinov and N.M. Rasulov have prepared scientific-methodological guidance related to evaluating innovative effectiveness of the practices in the entities which make big difference among students learning this sphere.

Some of the specialists in road construction industry Ravshanov who used evaluation methods in assessing capabilities of road and transportation complexes and T.U. Qodirov who used this system in assessing effectiveness of competitiveness of road transport system has managed to evaluate effectiveness criteria in using social and economic resources.

For this reason, due to absence of research papers associated with methodological bases of assessing the effectiveness of innovative marketing in road transport industry among the works of scientists whose works have been analyzed we decided to systemize evaluation criteria.

MAIN PART OF THE RESEARCH

In order to investigate the criteria clarifying effectiveness of innovative marketing practices in the market of road transport services, first of all, those criteria are selected according to their features and then their results are systemized.

Table 1

The system of the indicators and criteria which clarify effectiveness of innovative marketing practices in road transports.

№	Criteria	Content of criteria
1	Economic	This criteria provides the capacity associated with the provision of transportation and logistics services as well as economic productivity of road transport organizations by using existing fund and turnover finance appropriately.
2	Social	Social factors clarify the provision of qualitative and reasonable transportation services

		to community, convenience of transportation modes as well as the importance of level of such kind of amenities to society.
3	Financial	This criterion defines the capabilities of road transport organizations in terms of financing their operations and clarifies financial sustainability of the organization, whether the entity possesses financial resources which are essential for its operations and is able to pay its debts.
4	Marketing and management	It defines the effectiveness of managements decisions in marketing as well as transportation service practices related to satisfying the demand of society to transportation services by innovative ways.
5	Technical-operational	This criteria, which illustrates technical, technological and economic features of road transport organizations, clarifies the ways of choosing appropriate transportation modes and utilizing them efficiently.
6	Ecologic	It explains ecologic cleanliness and negative effect of transporting to people and environment during the process of providing transportation services.
7	Ergonomic	It clarifies ergonomic, physiological ,psychological and health requirements while providing transportation services.
8	Safety	It provides ecologic, conveying, mobility safeties of transportation modes and commuters when performing transportation services.

The following are the measurement groups of the criteria that clarify the effectiveness of innovative marketing practices in road transport:

1. Economic indicators defining the effectiveness of innovative marketing practices: the capacity of carrying commuters and load; turnover of load and commuters; the park of transportation modes and their infrastructures; conveying area and its utilization level; provision of technical service and repairing to transportation modes and their quality measures; revenue and profit of an entity; rate of revenue; overall and conveying profitability cost of transporting and others

2. Social indicators defining the effectiveness of innovative marketing practices: satisfaction level of customers in transportation service system; availability of transportation modes in the area; opportunities of using transportation services; comfort ability of transportation modes and the importance of its functions to society.

3. Financial indicators defining the effectiveness of innovative marketing practices: financial capacity; liquidity ratio; ratio of effectiveness; financial sustainability ratio; profitability ratio; indicators of its attractiveness to provide investment.

4. Marketing and management indicators defining the effectiveness of innovative marketing practices: share in the market of transportation services; brand of transportation organization and its popularity; tariff policy and its flexibility; technology, technical tools and organizational mobility of service; advertising practices; news related to market of transportation services, its acquisition and recycling quality; tariff of transporting; discounts; capabilities of management and engineering staff; structure of management; quality communication technologies used in management; strategic level of implementing management decisions.

5. Technical-operational indicators defining the effectiveness of innovative marketing practices: number of automobiles in the list of vehicles in automobile transport organizations; overall carrying capability of automobile transport organizations (overall passenger capacity); average daily distance of an automobile; annual distance of automobiles; overall distance of automobile with load; overall number of movements; ratio of technical readiness of automobiles; operational ratio of automobiles; average operational speed; capacities of loading; economization; reliability, utilization of weight and size.

6. Ecologic indicators defining the effectiveness of innovative marketing practices: ecologic cleanliness of carrying during transportation services; negative effect to environment and human health; ecological level of fuel; ecological impact of road and infrastructure facilities.

7. Operational indicators defining the effectiveness of innovative marketing practices: health requirements; anthropometric requirements; physiological requirements; psychological requirements; cultural-ethical requirements and others.

8. Safety indicators defining the effectiveness of innovative marketing practices: safety of passengers while providing transportation services; safety of the movement of transportation modes; labor safety; ecological safety; carrying safety; safety of drivers and technic staff. Our research results related to the effectiveness of innovative marketing practices in road transport system show that organizations should rely on a methodology based on the features of chosen criteria.

RESULTS OF THE RESEARCH

The methodology of evaluating effectiveness enables to make appropriate decisions in innovative development of road transport organization's practices, complex investigation of transportation service markets and determining innovative practice areas, issuing measures related to increasing marketing and innovative capabilities in transportation organizations and future prosperities of transportation service systems in the country.

All above mentioned processes will be united and it will be used in systemizing criteria in evaluating effectiveness of innovative marketing practices in road transport system and selecting indicators. After that appropriate method of evaluation will be created evaluations will be implemented. After that results will be analyzed for making correct decision.

In global practices innovative marketing practices are directed to forming the strategy of corporate competition and its effectiveness is evaluated for satisfying customers completely, gaining new markets and increasing sales volumes. During penetration into new markets, forming competition and pricing strategies show effectiveness of innovative marketing practices in life expectancy and brand of products.

Forming criteria which show effectiveness of innovative marketing practices in road transport system and applying its evaluation steps into practice enables entities to use methods of determining effectiveness of innovative marketing practices which eventually plays important role in making innovative development decisions of an organization.

CONCLUSION

From our point of view, these criteria explore the most important measures of evaluating innovative activities, lead all indicators to united assessment system, applying innovative transportation services into practice in the market of transportation system or allow to find of objective evaluations measurements in certain transportation system. In addition, relying on these criteria an opportunity to supervise services being provided by transportation modes immediately and compare results of an entity in different periods during the process of evaluation of innovative marketing effectiveness can be attained. Relying on this information it can be concluded that it is very crucial to select criteria of evaluating effectiveness of innovative marketing practices in road transport organizations.

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SECTION 29. Literature Folklore. Translation Studies.

PECULIAR WAYS OF ADEQUATE APPROACH IN POETIC INTERPRETATION

Abstract: *The article is dedicated to questions of approach on the basis of adequate and equivalent norms in poetic translation. With this view, it is analyzed as example of translation, translated into Russian by N.Tixonov, of poems titled "Na'matak" ("The sweetbrier"), "Yor ko`zlarining ishqini, xumorini yod et" ("Remember love, intense of sweetheart's eyes") by Oybek.*

Key words: *adequation, equivalent, equality, alternative, identative translation, poetic translation, style of author and translator.*

Language: *English*

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Introduction

Ability to come near to an adequate or equivalent degree to a form (metre, rhythm, foot, syllable, melodiousness, musical) and meaning (embodiment, lexical resures, stylistic figures) considered poetic parameters of an original in poetic translation provides reflection of an author's thought and feeling, purpose and idea.

While preserving all poetic elements incarnated in the original text, creation of an equivalent or adequate variant of a translation is too complicated process. That complicacy is that those functional units in the original text such as poetic works, expressive elements are not able to equalize to exact alternative degree within the bounds of other language. Deformation of original and also definition are allowed in order to avoid from those complicacies in translation of a poet, that is, a poetic translation requires that some kind of categories above mentioned is changed. Taking notice of these, the translation can choose a way of free approach in order to recreate a poetic form and meaning. This condition gives a free creation an opportunity in the theory of translation and it is required to keep norms of possibility like that in its turn. "Especially the archaic words translation we should more paid attention in classical literature. "[7,44]. When a way of free approach was chosen to recreate a poetic meaning and form by the translator in the text of translation, realization of equivalent and adequate translation of an original leads to hesitation of the translator, that is, naturally the questions arise that adequation and equivalent can bear their fruit without transformations and losses on condition that the translator has not recreated a translation of a poet. Meanwhile, adequation is an "exact" result of adequate original and translation which they are equal to each other. Equalization of original and text to a repeated text *in the adequate translation* is recreated without changes in content, aesthetically and functionally and it is translated as much as possible. Notion of t*he adequation* is to replace mark of equalibrium between original and translation, that is, two texts generate formal, semantic, literal closeness to each other and *an exact* aspect of the text is created pragmatically, methodically.

Materials and methods

One of main conditions of such translation is that some liberties – author's words and liquidations are not allowed. Though linguists, translators and specialists in literature have elaborated some conceptions of notions of equivalent and adequation, these important two categories of translation theory still remain within the scientific discussions. When Russian methodologist, specialist in translation, professor Lev Nelyubin began to introduce equivalent and adequate terms into "the explanatory dictionary of the terms of study of translation" [2,78] which he has compiled himself, he cites general

description of equivalent and adequate notions in interpretations on some variants, receiving main thoughts of conceptions elaborated by scientists. It is pointed out that "ad equation has three components at the bottom" in one of those descriptions: they are 1) to be reach meaning of original precision, exact, complete; 2) to be reach linguistic categories of original in nicety; 3) to be recreated in detail a language of primary text in language which is translated. *The equivalent* is conformity, equality, mutual semantic identity in the highest possible degree of meaning of original and translation. *The equivalent translation* is to be recreated meaning of original in one of kind of the equivalent. One can see that essence of the ad equation described by L.Nelyubin corresponds with essence of the equivalent in general sense, that is, precision, exact, complete statement of meaning of original requires to conform meaning of original of equivalent in the highest possible degree with translation. Sometimes there's some translating problems in translation process. Especially, the translation of person's name is difficult to translate it into foreign languages. It is used to be a reasonable manner for describing exactly and understanding clearly which the events in "Baburname" [8,1022].

In view of the fact that if approach requires without any changes in accordance with requirements of the absolute equivalent and ad equation, in this case, how is translation of a poem realized? In our opinion, thought which has been told that "it is not possible to approach to adequation and complete equivalent in interpretation" leads to one-sided view. So, work of any translation gives evident theoretical thought and conclusions by coming of its analyse.

So long as, it is not always possible to be absolutized thoughts within translation because changes of thoughts can occur as a result of analyze of work of any translation. The critique of translation differs from the other branches of the philology in this respect. As a argument of our opinion, we can give as an example of functional appearance of adequate and eqivalent approach which meet with translation of poems titled "Xayr, Chimyon" ("Goodbye Chimyon"), "Na'matak" ("The sweetbrier") concerning the group of "Chimyon daftari" ("Chimyon notebook") by Oybek, especially, in N.Tixonov's translation activity. If responsibility of the translator of poetry in guaranty of adequation is to show the making finest points of original pleasure, becoming a person of a poet the original, on the one hand, it is to understand in mental as a creator who interprites a purpose and ideas of the author under these poetic features, on the other hand. As a result, these two tasks are combined and distance between the original and translation is obtain to be approached as far as possible. For this reason, adequating the original shows that the translator has a high skill. Dildora Khoshimova wrote in her doctoral dissertation work about the functions of translator [6, p.191].

The poem "Na'matak" ("The sweetbrier") by the Uzbek poet Oybek is valued as one of unmatched lyric patterns which are reflecting artistically in the Uzbek poetry of the XX century. Ideal purpose of that poem which means that beauty is able to create good deed, is incarnated in the author's artistic aim. The figurative-expressive means, games of words which serve to be incarnated the poet's artistic aim repeat Oybek precisely not only thought with thought, phrase with phrase, form with form and also an order of metre, melodiousness of poem in its Russian translation. It is necessary to be mentioned, if relative equivalent operates in order to "be identified" a form of the original and its meaning, it is required to approach to the text of the original dynamically and formally. But each of both "are identified" to the original in adequation and complete equivalent as well. We can see that the exactness has been provided in formal and dynamic look as well in the Russian translation of N.Tixonov's the poem "Na'matak" ("The sweetbrier").

The structure of formalism comes of skill that it could reflect methodical features and author language in degree of the natural possibiblities but not with any copying out the methodical characteritics and grammatic peculiarities of the original in N.Tixonov's creative work:

Oybek:
Нафис чайқалади бир туп наъматак,
Юксакда, шамолнинг беланчагида,
Қуёшга кўтариб бир сават оқ гул!
Виқор-ла ўшшайган қоя лабида –
Нафис чайқалади бир туп наъматак... [3,182]

N.Tixonov:
Чудно качается куст наматака
Там, наверху в ветровой колыбели,
Солнцу – корзина цветов белоснежных.
Гордо над краем утесистой щели
Чудно качается куст наматака… [1,285]

Podstrochnik:
The branch of hamatak shakes wonderfully,
There, above in the wind cradle.
To the sun – in too white basket, majestic [3,182]

The original	**The translation**
The hemistishes	twenty twenty
The rhythm	metre metre
The number of	ten eleven syllables
The order of metre	
abvba, abbba	*abvba, abvba*
abvba, abbvva	*abvba, abvba*

We can be witness of that the order of metre was more perfect than the original. The poet who was influenced on condition “чайқалади” , “кўтаради”, “фусун беради”, “сўнмайди”, “тутади”, “салом беради”, “товланади” “рақс этади” - “shaken in the wind cradle fine” of namatak, brightens this image in actions such as “it shakes”, “it raises”, “it fascinates”, “it does not go out”, “it holds”, “it greets”, “it plays”, “it dances” in the poem. Whole allegorical phrases appeare in influence of those words and phrases which explicate action. The peak of that skill peculiar to Oybek’s poetry is repeated in N.Tixonov”s translation identically. Namely, “качается” (чудно качается куст наматака), “зардели” (а на щеках поцелуи зардели), “пляшет” (спутав побеги, цветами сияя), “пляшет” (пляшет создание скал одичавших) - “it shakes” (the bush of namatak shakes wonderfully) “they reddened” (the kisses reddened in the cheeks), “it dances” (entangling sprouts, beaming with flowers), “it dances” (it dances creation of the wild rocks).

It is necessary to pay attention to that, too, though the translator has translated sentences and phrases in the original felitously, he did not cite synonymic alternative of ”нозик”, “майин”, “нафис” - “graceful”, “soft”, “fine” epithets in the structure of the allegorical phrases from Russian word for word. The figurative-expressive means such as “graceful” “soft” “fine” which Oybek has created, are translated as a form of “чудно” (чудно качается куст наматака), “нежно” (мне не насытиться пляской той нежной), “чудно” (чудно кивает мне в скалах из мрака) - “wonderful” (the bush of namatak shakes wonderful), “fine” (I do not satiate with dancing of that fine), “wondweful” (the rocks of darkness nod me wonderful) in the translation of the translator. Reason of that approach which was a symbol of beuaty is that the author preserves his feelings who recognized that the namatak has fascinated to grandeur of rocks frowned with its *graceful,soft, fine* a ctions. So epithet of “нежно” in Russian can not present aethtitic magnificance of the word of “graceful” in the poem, that is, “shaking finely” of namatak in Oybek’s poem does not mean that tenderness action exactly, but it means that action is charming. The translator cites an analogy of “чудно” (“wonderful”) as equivalent and achives his aim while noticing meaning of “wonderful”, “charming” hiden in the base of this word.

It is clean that each creator has peculiar feature of poetic creative work whose whole creation is different from other creators. That charactiristics wins raders’ endless confidence when he creates patterns of too attractive, influence poems which were fomaus for readers and glorified the author to people. Sirdaryokhon Utanova is emphasized about the features of attractive and literary poems in her work. “Attractive poem is called the mark of person’s spiritual and aks attiruvchi mood of character position “speech”[9,64]. Those poems celebrate names of their authors to people and their translation into other languages are realized more fast. Namely, the poems such as “Urik gullaganda” (“When the apricot bloosoms”) by Hamid Olimjon, “Sen yetim emassan” (“You are not orphan”) by Gafur Gulom, “Go`zal” (“The beuaty”) by Chulpon, “O`zbegim” (“My Uzbek”) by Erkin Vokhidov made a poet famous. Including, “Namatak (“The sweetbrier”) is a pattern with high price in Oybek’s lyric creative work, too. Their qualities increase much more that national traditions could be seen in patterns of that poetry. One of features peculiar to charactiristics of Uzbek people is that events and phenomena in their imajinations occur not separating from flower and the sun. Symbols of the sun and the flower incornate a spirit of national tradations in Oybek’s lyrics that they are in leading place in his poetry. N.Tixonov reexpresses the author’s Uzbek romantic sense by feeling that the poetic symbol – namatak (“The sweetbrier”) was able to create beauty and the poet astonished beauty like that. For this reason, the title “Na`matak” of the poem is not as “ Шиповник” in Russian alternative in translation, on the contrary, it was remained the title of “Na’matak”.

Creation of complete equivalent or adequate tanslation of poetic work is aethetic phenomina coming of skill of the translator and mutual harmony of poetic view of point and of spiritual incornation, of creative closeness, of collaboration in styles of two persons – the author and the translator serve as a main factor. Professor G.Salomov thinks aptly that “it is confidence in mirakle that you have translated writer’s work or author’s well who you did not love and whose works you did not like youself” in his monograph [5,128]. N.Tixonov and Oybek are two leaders: the first is of Russian literature and the second is well-known poet, writer, translator and specialist in literature of Uzbek literature. They were poets whose ideological view of points conform to each other as resourceful publists in the social-political life. It is clear in broad sections of the readers that each both of creators were skillful to write their feelings in the poetic lines, too, who have created in the same literatural, political condition. As Oybek was himself a skilful translator, he considered N.Tixonov his close creator friend and he satisfied Russian translation of the poem “Na’matak (“The sweetbrier”) by N.Tixonov, the memories were recorded that he has told positive opinion about its translation [4,50]. So there are lyric poems by Oybek such as “Xayr, Chimyon!” (“Goodbay Chimyon”), “Ilk qor” (“The early snow”), “Yor ko`zlarining ishqini, xumorini yod et” (“Remember love, intense of sweetheart’s eyes”) in activity of N.Tixonov’s translation that translation of this poem is worthy of estimating as perfect translation, too.

Translation of this poem can meet to requirement of complete equivalent and adequation which we have mantioned above. For this reason, if the periods pass, these poems do not need to be retranslated by other translators. Namely, when the poem "Yor ko`zlarining ishqini, xumorini yod et" ("Remember love, intense of sweetheart's eyes") is compared with its translation, it is difficult to realize who the author of the original is and who the author of translation is. Therefore, interpretation of the original in comprision with Russian translation on condition of extraordinary identity is like "miracle", as G.Salomov affirmed:

Oybek:

Ёр кўзларининг ишқини, хуморини ёд эт!

Кўк гулшани дурлар каби порлайди бу оқшом.

Ҳар тоғда ва қирда ётар нозли бир ором,

Дунёдаги кўзлар аро шаҳлосини ёд эт. [3,184]

N.Tixonov:

Милой глаза, что влекут так безудержно,

Неба вечерний цветник - словно жемчужина краса,

На равнинах, в горах всё нежнее покой,всё укромней,

Среди глаза всего мира вспомни милой глаза. [1,307]

Podstrochniy:

One can not stop lover's drowing eyes.

The sky is flowering country like beuatiful pearls.

In heights, mountains there are thus much lovely rest, thus much lonely.

Remember lover's eyes among eyes in the world.

It became known that degree of complete alternative justifies itself in the poetic translation utterly.

Conclusion

We can conclude that the adequate translation appears in the poetic translation peculiarly, that is, adequation requires degression of liberty from the translator in the poetic translation in comparison with poetic work as far as possible. First of all by taking into consideration that the poetic translation is poetic interpretation that interpretation of the poetic translation shows that one of poetic elements can only be changed. Thought, spiritual, creative closeness with the poet gives apportunity to create adequate and complete equivalent translation methodologically. In most cases, when the poetic work is translated adequately and equivalently, after that translation it is not required to be retranslated and these translations are always valued as perfect ones in translation literature. For this reason, questions of alternative, exactness have still being remained one of disputable themes.

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SECTION4. Computer science and computer engineering.

METHODS OF INFORMATION PROCESSING IN OPTIMIZING MICRO GRID SYSTEM WITH DISTRIBUTED ELEMENTS

Abstract: *This article discusses the relevance of the creation and use of "smart" power grid, micro networks - micro grid in combination with renewable energy sources, the received information.*

Key words: *Micro Grid, micro-Network, intelligent network, a modular type of digital substation, hubs.*

Language: *English*

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Introduction

Tasks, based on actions on the most acceptable and rational use of reserves, while maintaining a certain degree of comfort of the existing (for a man) or a certain degree of existing production appear relevant to virtually every country.

It is permissible to create projects for clients systems and electric drives based on the established comfort level or order production.

Exceptionally claimed there is a problem with the requirements of the free market trade resource in which 1) there are options for the delivery of electricity and other resources, 2) in the presence of a variety of flexible tariffs, related to the period of the day, 3) the existence of variants of the origin of electricity. When such coincidence, there is a number of problems that need to be addressed.

One of the first problems is a clear prediction of power consumption. The next task may include a task related to the subject of the quality of information: how are true and correct all the data? In the case of information authentication problems occur, and suspicions about the correctness of the result. Another problem - the problem of energy conservation reserves detection - electricity used per day (a week), which can be saved under the specified conditions. Also among the important issues that today there are many power transmission and distribution organizations (including organization of water supply, gas transmission and gas distribution) are problems such as outdated network infrastructure, increasing the maximum loads, wide promotion of new power Generation technologies (renewable energy sources) the need to improve the quality of customer service, the need to maintain network security. Consequently, the problem of planning and development of "smart" energy-saving automation of procedures and structures are modern crisis in the application of information standards (technologies) in resource conservation.

Micro Network or system-micro grid

Micro grid Complex ("micro-network") it encompasses, typically one or a number of distribution substations and systems savings system that allows it to operate as a stand-alone or be combined with an external power system. Micro grid Network have different sizes, from small networks to provide power a small number of residential units to large energy supply systems of business organizations and institutions. [1]

Usually micro grids are erected for a small period of time to meet the local needs in electric power and do not carry out the provision of electricity over long distances. [2]

Complex micro grid with renewable energy sources (for example, the use of hubs and solar, vertically positioned wind turbine and hydrogen stand-alone installation), as part of the power system Smart Grid provide an opportunity to create a full range of acquisition, use and conservation of electricity. All this is quite in demand for staying areas, work or life without complex approach to the central power.

The concept of "smart grid"

Intelligent "smart" electricity grid - a fresh set of visions of the importance of technology to modernize energy infrastructure, to review our obligations both energy consumers and, ultimately, in the issue of preservation and protection of nature and the much-needed energy.

The formulation of the concept of "smart grid" US Department of Energy as follows: "Smart Grid - a method of producing electricity from energy companies to customers, combined with a variety of technologies and an improved power system activities explicitness, efficient customer service and presenting the environmental dignity>>.Despite the different interpretations of the concept of the smart grid is no doubt that communication network appears the foundation of intellectual power. Companies in the electricity sector are investing in communications networks to improve the situational awareness of the reserves of the energy system with the desire for automation, control systems and unite them. The advantage of the intellectual energy is that electricity companies will be able to "soften" the need for electricity during peak periods, to renounce the use of hot resources, and reduce the need for long-term capital investments in the development of additional generating associations also reduce the need for other investments, for example, modification to the system to enhance the productivity. The existence of the four properties of the "smart" network combined to make intelligent power grid (Figure 1). The foundation of a modernized power grid are intelligent components, staying at the level of digital technology, which is connected to the electric power company established and current analog infrastructure of the energy system. [3]

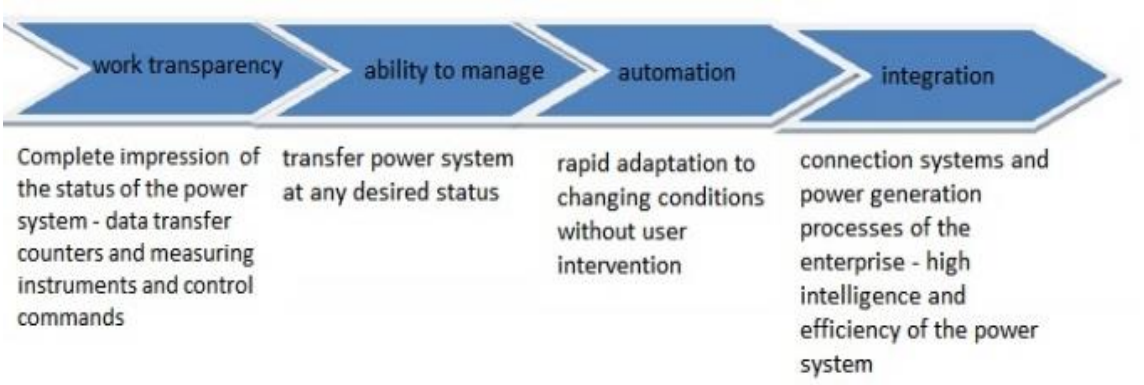

Figure 1- Smart Grid-element.

The advantages of the intelligent network are:

• Effectiveness in operations - reduce power embezzlement - and improving interminableness payments through automated complexes reading data recording devices;

• Perfect reaction - to minimize the maximum possible load with smart fixtures accounting allows you to enter the rates associated with the use of time;

• Network security - forming predictions of resource use to improve the set of network settings in real time, which will contribute to the art work in full force its actual capacity;

• Actual current communication standards - the ability to integrate the intelligent options in all electrical infrastructure, from power substation to customer equipment.

Intelligent network device can be described by the following categories:

• intelligent grid includes options for monitoring and observation of mains producing capacities in order to diminish the load, measurement of protection also supports reliable and productive energy delivery.

• Renewable energy;

• Intelligent transfer of information covers and sharing current data devices and counters located throughout the country;

• Intelligent control spending and ensure increased efficiency, reliability and security of the network by automating the supply and control the reaction to unforeseen circumstances.

One of the main components of the smart grid appear on the digital substation, in which embodied urgent solutions and standards to monitor the power grid equipment.

Economic circumstances and the business advantages of digital substation automation:

• Reducing the current embezzlement.

Modern substation make it possible to reduce the current embezzlement due to the merger of a number of control and monitoring into a single IP-based network. This fact provides the highest degree of importance for traffic control and operational data.

• Reduction of capital embezzlement. Due to the fact that the demand for electricity is growing electric power companies need to find methods of

generating power to meet these needs during peak periods. One method is the use of the automation station techniques for large-scale reduction of the maximum load and demand management, which will enable to reduce the number of additional power plants to provide power during periods of peak demand on the electricity grid.

• providing a distributed intelligence. Because intelligent network control options within reach, not only in terms of limited control center, but also for sub-stations, there is a possibility of designing new applications that allow to distribute options protection, control and automation technology.[4]

• Increased security of the power system. Question to guarantee power system information security covers not only the protection of the substation borders, but also the formation of an absolutely secure architecture that allows to find the maximum plausible concept of the entire network, mechanisms and accidents.

Renewable energy sources

Many Russian regions have all the requirements for the formation of distributed generation, we are talking about the possibilities of solar energy and wind energy. Renewable energy sources have great importance in solving the issues of energy security, the environment and corruption of climate change. [5, 6]

To motivate electricity generation production facilities, operating on the basis of renewable energy sources is required to adopt manuals calculation of tariffs for electricity created in renewable energy facilities. [7, 8]

Intelligent data exchange

Without reliable and accurate communications grid - this is nothing more than 'deliver.' Power. To make it "smart" is necessary to ensure the exchange of information in both directions.

Sharing information allows energy production to solve several major problems: intelligent surveillance, protection and guarantee of "smoothing" the load. Through the exchange of information in both directions, and the readings of meters located throughout the network, accumulate and are available directly to the network controller to the operator.

The communication structure of intelligent networks have identified a number of sections:

• Regional - WAN. It includes a large territory and connects the control center with local networks. It can be created using fiber or wireless communication method in accordance with the Ethernet or cellular protocols.

• Local - NAN. This network manages all data transmitted between the regional and domestic network of high-voltage rails. In this case, used or wireless communication, or communication power supply rails.

• Home - HAN. It creates conditions for an extreme objects - residential buildings or organizations.

All of these sections are interconnected via devices - hubs, set between the regional and local network, or electronic devices between the home and the local network. [9]

"Smart" Energy consumption and control

It is significant to modernize the management and control of energy consumption, this requires a complex aggregate measurements. Communication, broadcasting and returns information about how to use energy, creates advantages and helps to reduce the loss. While more distinct and clear data for power consumption allows users to master their indifference to energy issues. [10]

These error-free measurements are needed in order to investigate, approve or modify one of the samples of energy wastage. It is essential to realize the management of the use of energy and to receive data service systems and recognition of deviations.

Conclusion

In the complexes of "smart" accounting be applied one or multi-phase modular instruments. "Smart" sensors can check the relationship of power usage by time and allow the utility companies to provide discount system for customers to change the structure of energy consumption. For the unlimited introduction of automation, we need to provide customers with an alternative to the admissibility and the increased range of services.

Client due to smart metering is always on time gets through, which clearly expresses the information on consumption. This helps the client time to pay the bills and, as a result, favorable to conquer much of the honest taxpayers in each consumer structure.

Moreover, information about consumers can easily combine data from external systems check the solvency of consumers to improve risk assessment. This is the most significant in cooperation with corporate customers.

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SECTION 21. Pedagogy. Psychology. Innovations in the field of education.

THE PROBLEM OF STUDYING OF THE PERSONALITY TRAITS' EXPRESSION IN THE ACOUSTIC CHARACTERISTICS OF SPEECH

Abstract: *This paper analyzes the results of studies of the acoustic correlates of individual psychological characteristics of personality. The experimental problems that must be solved in order to create an integrated model of the personality traits' expression in the acoustic characteristics of speech are discussed. The possible physiological mechanisms of the manifestation of personality characteristics in the speech signal are considered.*

Key words: *acoustic characteristics, voice, personality, personality traits, speech, speech signal.*

Language: *Russian*

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ПРОБЛЕМА ИССЛЕДОВАНИЯ ВЫРАЖЕНИЯ СВОЙСТВ ЛИЧНОСТИ В АКУСТИЧЕСКИХ ХАРАКТЕРИСТИКАХ РЕЧИ

Аннотация: *В работе проанализированы результаты исследований акустических коррелятов индивидуально-психологических особенностей личности. Обсуждаются экспериментальные задачи, которые необходимо решить для того, чтобы построить интегральную модель выражения личностных свойств в акустических характеристиках речи. Рассмотрены возможные психофизиологические механизмы проявления личностных особенностей в речевом сигнале.*

Ключевые слова: *акустические характеристики, голос, личность, личностные свойства, речь, речевой сигнал.*

Introduction

Многочисленные экспериментальные исследования, выполненные в контексте изучения психофизиологических и психологических основ невербального общения, показывают, что кроме лингвистической информации речевой сигнал является носителем самого разнообразного содержания. Через слуховой канал можно получить эмоциональную, эстетическую, индивидуально-личностную, биофизическую, социально-типологическую, пространственную, психологическую и медицинскую информацию о говорящем, информацию о физических помехах, сопутствующих речепорождению [16]. В настоящей работе мы попытаемся понять, существуют ли объективные акустические корреляты устойчивых индивидуально-психологических особенностей личности?

Materials and Methods

Проблемы выражения в речи различных функциональных и эмоциональных состояний давно интересуют ученых. Основы этого направления исследований, по-видимому, были заложены Ч. Дарвином (1872) в работе «О выражении эмоций у человека и животных» [10]. Экспериментальное развитие акустический подход к изучению психоэмоциональных состояний получил в связи с разработкой акустической теории речеобразования [11; 13]. В России практическая востребованность исследований речи стали причиной проведения симпозиумов «Речь и эмоции» (1974) и «Речь, эмоции и личность» (1978) и совещаний по акустике речи и слуха (АРСО). Было обнаружено, что информативными акустическими коррелятами психоэмоциональных состояний являются: показатели (среднее, максимальное и

минимальное значение, дисперсия, диапазон) частоты основного тона (F_0), формантных частот (F_1, F_2,.. F_n) и ширины формантных зон (B_1, B_2,.. B_n), огибающей спектра, интенсивности речи (I), распределения низко- и высокочастотной энергии в спектре, формы интонационного контура высказывания. Востребованными оказались временные характеристики: латентное время ответной реакции, длительность и темп речи, длительность (t) пауз, ударных гласных, слогов и фраз. В целом, исследования демонстрируют, что стенические состояния ведут к возрастанию, а астенические – к понижению показателей F_0, F_n и I. Эта связь обусловлена индивидуальными особенностями говорящих: половыми различиями, степенью экстра/интроверсии, уровнем нейротизма и тормозным/возбудимым типом реагирования [1]. Вместе с тем, обнаружено, что при возникновении различных психоэмоциональных состояний показатели F_0, I и темпа речи изменяются взаимосвязано. Было бы неверно без тщательной экспериментальной проверки опираться на каждую из указанных выше характеристик голоса в отдельности как на показатель, обладающий дифференцирующей силой [4].

Изучению акустических коррелятов свойств темперамента и личности посвящены единичные исследования. Например, на русскоязычной выборке мужчин А.В. Никоновым и Е.В. Беловол (2000) обнаружено, что лица, относящиеся к разным типам темперамента, отличаются по F_0 и ее производным; эмоциональность прямо, а эргичность (желание умственного и физического напряжения, избыток сил) – обратно пропорционально связаны с показателями F_0 [17]. Вопрос о механизмах обнаруженных связей, как правило, остается за рамками подобных исследований. Вопрос о создании целостной концепции проявлений психологической индивидуальности в параметрах голоса на сегодняшний день по-прежнему открыт. Разработка модели диагностики разноуровневых психологических особенностей по акустическим параметрам речи позволила бы: проводить комплексную психодиагностику индивидуальности; сократить временные и энергетические затраты на осуществление индивидуально-психологического обследования; расширить диапазон применения психологического тестирования (распространить на ситуации, когда использование бланковых психодиагностических методик не возможно или не рекомендуется, например, в клинической практике: при отсутствии мотивации к обследованию, высокой вероятности проявления социальной желательности в ответах обследуемого и т.п.). Для построения такой интегральной модели требуется решить ряд задач [6].

Во-первых, необходимо определиться с акустическими характеристиками речи, которые должны быть выделены из речевого сигнала, обеспечить их адекватную регистрацию и обработку. Эта проблема хорошо разработана в контексте акустической теории речеобразования [11; 13] и прикладной фонетики [22].

Во-вторых, необходимо установить степень межиндивидуальной вариативности акустических характеристик голоса. Малая изменчивость того или иного акустического параметра не позволяет рассматривать его в качестве индивидуальной характеристики голоса человека. Этому вопросу уделялось значительно меньше внимания. Показано, что ряд акустических характеристик обладает существенной межиндивидуальной изменчивостью [5; 7; 8; 9; 12]. Возможно выделение типологических акустических особенностей в зависимости от характера речевой деятельности [15].

В-третьих, необходимо выяснить внутриндивидуальную стабильность выделенных параметров. Этот вопрос оказался наименее разработанным. В ряде исследований обнаружена внутриндивидуальная стабильность показателей F_0 при произнесении разнородного языкового материала [2], показателей F_0–F_4 и B_1–B_4 при произнесении слогов [7; 8], чтении текста [9] и свободном рассказе [5]. Стабильность акустических характеристик при изложении языкового материала в иных (экспериментальных и приближенных к реальной жизнедеятельности) контекстах требует экспериментальной проверки.

Четвертым вопросом, дополнительным для решения рассматриваемой проблемы, является изучение вклада наследственных и средовых факторов в формирование индивидуальных особенностей голоса. На сегодняшний день в силу различных методических причин этот вопрос открыт [3]. На русскоязычной выборке близнецов показано, что индивидуальные показатели F_0 и F_1–F_3 находятся под воздействием факторов наследственности и индивидуальной среды; умеренные общесредовые влияния на формирование индивидуальных различий по средним значениям F_2 и F_3 объясняются фонетическими особенностями произносимого материала [8]. Основываясь на знании о генотип-средовых соотношениях различных индивидуально-психологических особенностей человека и акустических параметров речи, окажется возможным определить пределы корреляций между психологическими и акустическими показателями и выдвинуть предположения о механизме этих связей.

Только после решения этих задач можно переходить к изучению *пятого* вопроса – выявлению акустических коррелятов устойчивых личностных характеристик. Таких исследований – единицы. Кроме упомянутой выше работы А.В. Никонова и Е.В. Беловол (2000), на выборке русскоязычных испытуемых, с учетом всех обсуждаемых в данном разделе проблем, выполнено еще несколько исследований. Они показали, что некоторые средние и показатели внутриндивидуальной вариативности F_0, F_2, F_3, B_1 и B_3 могут быть маркерами представленности в структуре личности (по данным опросника *MMPI*) компонентов: мужественность-женственность, психопатия, гипомания, психастения, ипохондрия и истерия [5; 9].

Выявление психофизиологического механизма реализации индивидуально-психологических свойств личности в акустических характеристиках голоса является *шестой* (и наиболее сложной!) задачей, которая должна быть изучена в контексте рассматриваемой темы. Рассмотрим этот вопрос подробнее. Существует несколько возможных психофизиологических механизмов выражения личностных особенностей в акустических показателях речи.

1) Наиболее очевидная связь психологических характеристик может наблюдаться с F_0. Средняя F_0 обычно соответствует привычной для индивида частоте колебания голосовых связок. Исследования, проведенные в русле генетики поведения, наглядно демонстрируют, что вклад наследственных факторов в индивидуальные различия по F_0 составляет примерно 50%. А значит, остальная часть фенотипической дисперсии по средним значениям F_0 обусловлена ситуативными или долговременными средовыми влияниями [8]. В качестве одного из таких средовых факторов, например, можно рассматривать нетипичный для индивида уровень напряжения голосовых связок вследствие какого-либо переживаемого психического состояния, что приводит к повышению «базовой» F_0. Например, предполагалось, что у депрессивных больных F_0 ниже, чем у здоровых индивидов. Однако обнаружено, что в среднем F_0 у таких больных не отличается от нормы. При этом депрессивные больные говорят тихо в силу низкого уровня подглоттального давления. Иными словами, чтобы сохранить среднюю F_0 на уровне нормы, больным приходится чрезмерно напрягать голосовые связки [18]. К сожалению, F_0 является не лучшим акустическим показателем устойчивых индивидуально-психологических особенностей человека, поскольку можно предположить, что дикторы способны произвольно контролировать изменения этой характеристики в процессе речепроизводства.

2) Индивидуально-личностные особенности могут выражаться в устойчивых характеристиках *F*-картины. Относительное расположение энергетических пиков, соответствующих частоте основного тона и формантным частотам (F_1–F_0, F_2–F_1,... F_n–F_{n-1}), позволяет нам, независимо от присущих речи диктора устойчивых особенностей расположения формант, опознавать отдельные фонемы. F_n с такой функцией выдающийся российский ученый Н.И. Жинкин (1958) называл речевыми формантами; они определены нормами языка. Физиологическим обеспечением сдвига F_n относительно друг друга являются ситуативные изменения длины вокального тракта. Абсолютные устойчивые частотные характеристики формант (F_n) конкретного диктора, зависящие от конфигурации его голосового тракта, создают специфическую тембровую окраску речи индивида и, соответственно, позволяют опознать его по голосу. Такие F_n, которые могут быть вычислены посредством усреднения значений по каждой из формант, полученных в зависимости от специфики конкретных звуков, были названы голосовыми формантами [21]. Голосовые форманты обусловлены анатомическими особенностями строения голосового тракта. Однако данные исследований, проведенных в русле генетики поведения, указывают на существенную средовую обусловленность индивидуальных особенностей F_n [7; 8]. Так, в качестве фактора, создающего средовую вариативность F_n, можно расценивать произвольные изменения *F*-картины посредством манипуляций с артикуляционным аппаратом: например, продвижение языка вперед, подъем нижней челюсти и гортани способствует уменьшению длины вокального тракта и, как следствие, ведет к повышению формант. Эти приемы используются специалистами в работе с мужчинами, меняющими сексуальную ориентацию в целях приближения в речи к стандартам женственности [19]. Очевидно, что именно особенности голосовых формант человека могут быть коррелятами его психологических характеристик. Тем не менее, разности F_n–F_{n-1} также могут нести важную психологическую нагрузку. При отклонении разностей между формантами от предполагаемых в фонетике канонических величин, фонемы становятся мало различимы на слух, гласные звуки начинают сливаться. Такие устойчивые особенности говорения («вялая» артикуляция) могут выражать отсутствие коммуникативной цели быть понятым окружающими, что, в свою очередь, может отражать устойчивые личностные особенности индивида.

3) В качестве одного из коррелятов индивидуально-психологических особенностей человека может выступать относительная концентрация энергии в низко- (*Lower Frequency Region, LFR*) и высокочастотной (*Higher Frequency Region, HFR*) областях спектра. Увеличение энергии в *LFR* (обычно рассчитывается по области ниже 1000 *Гц*) наблюдается при общем снижении мышечного напряжения, что должно отражаться и на расслаблении мышц, задействованных в процессе речепроизводства. Данный феномен обнаружен при изучении влияния психотерапевтических (на примере психических заболеваний) и медикаментозных воздействий (на примере группы нормы) на мышечное напряжение, что одновременно коррелировало с увеличением доли спектральной энергии в *LFR*. Напротив, концентрация энергетического максимума в *HFR*, отмечается при общем повышении мышечного напряжения [14; 20]. Тогда устойчиво высокая доля энергии в *HFR* будет указывать на то, что индивид находится в состоянии постоянного психоэмоционального и физического напряжения и наоборот. Обзор работ, касающихся выражения в акустических показателях речи психоэмоциональных состояний, показывает, что при возникновении тех или иных состояний наблюдаются взаимосвязанные изменения B_n и доли спектральной энергии в *LFR* или *HFR* [4]. Таким образом, в основе связей B_1 со шкалой психастении и B_3 со шкалой гипомании (по данным опросника *MMPI*), обнаруженных в исследовании Д.Н. Чернова с соавт. (2008), могут лежать изменения относительной доли энергии в *LFR* или *HFR*. Физиологической основой этих связей может быть пониженный или повышенный общий тонус мышц и степень напряженности мышц, задействованных в процессе речепроизводства, в частности. Впрочем, эти предположения требуют дополнительной экспериментальной проверки.

Conclusion

Таким образом, изучению психофизиологических механизмов реализации личностных особенностей человека в его голосе должны быть посвящены специальные психофизиологические исследования, что требует интеграции усилий специалистов в области психологии, физиологии и акустики речи.

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SECTION 6. Metallurgy and energy.

SHRINKAGE OF SOME METAL ALLOYS AFTER SOLIDIFICATION

Abstract: *The calculated values of shrinkage of the metal ingots of the circular cross section after solidification in the mould are presented in the article.*

Key words: *shrinkage, solidification, steel, cast iron, a casting.*

Language: *Russian*

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УСАДКА НЕКОТОРЫХ МЕТАЛЛИЧЕСКИХ СПЛАВОВ ПОСЛЕ ПРОЦЕССА ЗАТВЕРДЕВАНИЯ

Аннотация: *В статье представлены расчетные значения усадки металлических слитков круглого сечения после затвердевания в литейной форме.*

Ключевые слова: *усадка, затвердевание, сталь, чугун, отливка.*

Введение

Усадка возникает во всех фазах материала (в жидком состоянии, при охлаждении и после затвердевания) из которого изготавливается отливка. Усадка представляет собой изменение (уменьшение) габаритных размеров отливок при их охлаждении [1]. На величину линейной или объемной усадки отливок, изготовленных из различных металлических сплавов, влияет ряд факторов, в том числе и процентное содержание легирующих элементов.

Компьютерное моделирование позволяет имитировать реальный процесс литья от заполнения расплавом литейной формы до полного затвердевания отливки с расчетом величины усадки. Преимуществом применения специальных компьютерных программ является высокая точность расчетов и возможность моделирования процесса литья любого сплава.

Материалы и методы исследования

Моделирование процесса литья слитков и последующий расчет усадки различных сплавов осуществлялись в компьютерной программе LVMFlow. Процесс литья слитков из различных металлических сплавов выполнялся при одинаковых условиях. В качестве материалов отливок принимались следующие сплавы:

1. Легированная сталь для отливок марки 20ГТЛ [2]. Химический состав сплава: железо – 97.18 %, углерод – 0.22 %, кремний – 0.4 %, марганец – 1.2 %, хром – 0.2 %, фосфор и сера – 0.04 %, медь – 0.5 %, никель – 0.2 %, титан – 0.02 %. Порог текучести сплава – 70 %, порог протекания – 30 %.

2. Углеродистая сталь марки SS1505. Химический состав сплава: железо – 98.7 %, углерод – 0.25 %, кремний – 0.3 %, марганец – 0.6 %, хром – 0.01 %, фосфор – 0.03 %, сера – 0.02 %, медь – 0.07 %, молибден и никель – 0.01 %. Порог текучести и порог протекания сплава – 70 %.

3. Коррозионно-стойкая сталь марки 321 [3]. Химический состав сплава: железо – 69.75 %, никель – 9 %, хром – 18 %, кремний – 0.5 %, марганец – 1.5 %, углерод – 0.12 %, медь – 0.1 %, титан – 1 %, фосфор – 0.02 %, сера – 0.01 %. Порог текучести сплава – 70 %, порог протекания – 30 %.

4. Серый чугун марки EN-GJL-350 [4]. Химический состав сплава: железо – 94.7 %, углерод – 3 %, кремний – 1.3 %, марганец – 0.9 %, фосфор и сера – 0.05 %. Порог текучести сплава – 50 %, порог протекания – 30 %.

5. Ковкий чугун с шаровидным графитом марки EN-GJS-500 [5]. Химический состав сплава: железо – 93.83 %, углерод – 3.4 %,

кремний – 2.4 %, марганец – 0.3 %, фосфор – 0.02 %, сера – 0.01 %, магний – 0.04 %. Порог текучести сплава – 70 %, порог протекания – 30 %.

6. Безоловянная бронза марки CC330G [6]. Химический состав сплава: медь – 90 %, алюминий – 9 %, железо – 0.5 %, марганец – 0.1 %, никель – 0.4 %. Порог текучести и протекания сплава – 30 %.

7. Свинцовая латунь марки C85700 [7]. Химический состав сплава: медь – 61.7 %, цинк – 35 %, алюминий – 0.4 %, железо – 0.3 %, никель – 0.6 %, олово и свинец – 1 %. Порог текучести и протекания сплава – 30 %.

8. Алюминиевый литейный сплав марки AlSi12 [8]. Химический состав сплава: алюминий – 88.4 %, кремний – 11.2 %, марганец – 0.08 %, медь – 0.03 %, железо – 0.15 %, цинк – 0.05 %, титан – 0.09 %. Порог текучести сплава – 70 %, порог протекания – 30 %.

9. Цинковый сплав марки ZA-27 [9]. Химический состав сплава: цинк – 72.65 %, алюминий – 25 %, магний – 0.01 %, медь – 2.25 %, железо – 0.07 %, свинец и кадмий – 0.01 %. Порог текучести и протекания сплава – 30 %.

Начальные температуры каждого сплава до моделирования процесса литья слитков круглого сечения представлены в табл. 1.

Таблица 1

Начальные температуры расплавов.

Наименование сплава	Температура, °С
20ГТЛ	1600
SS1505	1610
321	1540
EN-GJL-350	1340
EN-GJS-500	1290
CC330G	1130
C85700	1010
AlSi12	690
ZA-27	580

Более точные результаты компьютерного моделирования были получены при учете конвекции и газа во время заполнения литейной формы расплавом. Начальное давление газа в литейной форме и давление газа снаружи литейной формы приняты величиной 1 бар.

Результаты и их обсуждение

В соответствии с выполненным расчетом отливка из литейного сплава марки AlSi12 имеет наименьшую массу. Обозначим массу данной отливки $m_{al.}$ (кг). Тогда расчетные массы отливок из других сплавов можно представить в следующем виде:

$2.9431m_{al.}$ – для сплава марки 20ГТЛ;
$2.9431m_{al.}$ – для сплава марки SS1505;
$2.9649m_{al.}$ – для сплава марки 321;
$2.9934m_{al.}$ – для сплава марки EN-GJL-350;
$2.8884m_{al.}$ – для сплава марки EN-GJS-500;
$3.1903m_{al.}$ – для сплава марки CC330G;
$3.3238m_{al.}$ – для сплава марки C85700;
$2.3041m_{al.}$ – для сплава марки ZA-27.

Наименьшее время охлаждения определено для слитка, изготовленного из стали марки SS1505. Обозначим время охлаждения данной отливки $t_{cl.st.}$ (с). Тогда расчетное время охлаждения отливок из других сплавов можно представить в следующем виде:

$1.1851t_{cl.st.}$ – для сплава марки 20ГТЛ;
$1.2119t_{cl.st.}$ – для сплава марки 321;
$2.7668t_{cl.st.}$ – для сплава марки EN-GJL-350;
$2.642t_{cl.st.}$ – для сплава марки EN-GJS-500;
$2.2272t_{cl.st.}$ – для сплава марки CC330G;
$1.2971t_{cl.st.}$ – для сплава марки C85700;
$2.2113t_{cl.st.}$ – для сплава марки AlSi12;
$4.4114t_{cl.st.}$ – для сплава марки ZA-27.

Таким образом, можно сказать, что процесс охлаждения слитка из цинкового сплава марки ZA-27 наиболее продолжителен по сравнению с охлаждением слитков из других сплавов (с учетом одинаковой конфигурации выливаемых отливок).

Усадка наиболее выражена в тех слоях материала отливок, которые затвердевают в последнюю очередь.

Расчетные значения усадки слитков после затвердевания представлены в табл. 2.

Таблица 2

Усадка слитков после затвердевания.

Наименование сплава	Усадка, %
20ГТЛ	3.37
SS1505	2.28
321	3.19
EN-GJL-350	2.98
EN-GJS-500	1.82
CC330G	2.61
C85700	3.23
AISi12	6.25
ZA-27	5.09

Минимальное уменьшение объема после процесса затвердевания наблюдается у отливок, изготовленных из сплавов на основе железа (в частности ковкий чугун марки EN-GJS-500 и качественная углеродистая сталь марки SS1505). Максимальное уменьшение объема наблюдается у отливок, изготовленных из цветных сплавов (в частности алюминиевый литейный сплав марки AISi12 и цинковый сплав марки ZA-27).

Уменьшение усадки в чугунах достигается при изменении содержания таких легирующих элементов как углерод и марганец. Уменьшение усадки в сталях обуславливается малым процентным содержанием углерода (до 0.25 %). Снижение содержания марганца, хрома и особенно серы (вредная примесь) также способствует уменьшению усадочного явления. Высокое содержание алюминия в цветных сплавах приводит к увеличению усадки отливки. При увеличении содержания меди в сплаве наблюдается уменьшение усадки отливки после затвердевания.

Заключение

Таким образом, принимая во внимание полученные результаты моделирования, можно сделать следующие выводы:

1. Цинковый сплав марки ZA-27, имеющий в три раза меньшую температуру плавления, чем температура плавления углеродистой или легированной сталей рассмотренных марок, охлаждается медленно в литейной форме с минимальным образованием остаточных напряжений в слитке.

2. Алюминиевый литейный сплав марки AISi12 после затвердевания имеет наибольшую усадку. Данные расчетные значения позволяют выполнять проектирование необходимых размеров и конфигурации литейной оснастки с учетом изменения размеров отливки.

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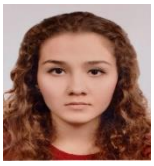

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INFLUENCE OF AGE, ACCOMPANYING DISEASES AND ALSO HIGHLY TREATED TREATMENT AT FREQUENCY OF FREQUENCY OF POSTOPERATIVE COMPLICATIONS AFTER HYSTERECTOMY CONDUCTED

Abstract: *Hysterectomy is a complete one (extirpation) or partial removal of the uterus (amputation). This operation is performed in malignant tumors of the uterus, cervix or ovary and in some cases with such diseases like an uterine myoma, endometriosis, etc. Hysterectomy is indicated for benign and malignant tumors of the uterus, cervix and ovaries. This article considers the influence of age, concomitant pathology, timely diagnosis and treatment on the incidence of postoperative complications after hysterectomy in patients with oncopathology. The study was conducted on the basis of the Regional Oncology Dispensary No. 1 in Krasnodar. The age of the patients varied from 24 to 80 years. Patients underwent extirpation of the uterus and appendages or Wertheim surgery. A histological study was performed. The diagnosis was based on the received histogram.*

Key words: *hysterectomy, endometrial hyperplasia, cervical cancer, uterine cancer, atypical endometrial hyperplasia*

Language: *English*

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Introduction

Endometrium is the internal mucosa of the uterus body. Hyperplasia of the endometrium is characterized by an overgrowth of this envelope. Nowadays this pathology is very common and occurs in all age categories [1]. Myoma is the next most common disease among women. Myoma of the uterus is a benign and hormone-dependent tumor [2,9]. According to Kichigin O.V. Et al. (2013) the main risk factors for the development of uterine fibroids are: early age of 1 birth, abortion, arterial hypertension and hereditary predisposition [3]. Cervical cancer is a malignant neoplasm that occurs in the cervix. The main factors of its development include early onset of sexual activity,

early pregnancy, frequent change of sexual partners, smoking, infectious diseases, sexually transmitted diseases. However, undoubtedly the most important etiologic factor is the papilloma virus infection. In the structure of female oncology the cancer of the cervix takes the leading position. According to WHO, the human virus causes up to 500,000 new cases of cervical cancer every year in the world of papilloma and about 240,000 women die each year from this disease. The prevalence of cervical cancer ranks second after breast cancer [4, 10]. Cancer of the uterus body is also called endometrial carcinoma because the pathological process develops in the epithelial layer of the uterus. In the opinion of Yu.S. Sidorenko and colleagues (2004), the incidence of uterine body cancer is progressively increasing every year [5]. Atypical hyperplasia is a fairly broad concept that includes the entire variety of forms of the hyperplastic mucous membrane of the uterus, located in the middle between carcinoma and benign endometrial hyperplasia. Atypical hyperplasia recognition is possible only on the basis of histo-response [6, 11]. The glandular hyperplasia of the endometrium is called too strong, excessive proliferation of glandular tissue of the endometrium. It is important to differentiate it from glandular-cystic hyperplasia, containing razor-widened glands [7, 12].

Hysterectomy is used in the case of benign and malignant tumors of the uterus, cervix and ovaries. The number of hysterectomies has recently increased by ≈ 5.7% [8].

Object

Studying the influence of age and concomitant pathology on the incidence of postoperative hysterectomy's complications

Materials and methods

The study was carried out on the basis of State budgetary healthcare institution regional oncology clinic No.1. We analyzed 3160 case histories of the gynecological department from 2016 and selected 73 ones.

Results and discussion

Age varies from 24 to 80 years (median is 53.0). The uterus extirpation or the Wertheim surgery were done to the patients. The diagnosis was made on the basis of the received histo-response - 1. The endometrial hyperplasia was observed only in two age groups, namely 60-69 (2.74%) and 50-59 (1.37%) years; 2. Uterine fibroids were presented in almost all age groups: 60-69 years (1.37%), 40-49 years (6.85%), 70-79 (4.11%), 50-59 (9.59 %), 30-39 (5.48%), excepting the patients entering the age group of the youngest in this sample age (20-29) and patients whose age was between 80 and 89 years, 3. cervical cancer was encountered in all age groups excepting the patients aged from 70 to 89 years: 60 - 69 (5.48%), 40 - 49 (2.74%), 50 - 59 (6.85%), 30 - 39 (15.07 %), 20-29 (2.74%), 4. Uterine cancer was presented in all age groups, excepting 20-29 years: 60-69 (17.81%), 40-49 (6.85%), 70-79 (4.1 1%), 50-59 (9.59%), 30-39 (5.48%), 80-89 (1.37%); 5. Atypical endometrial hyperplasia was noted in the only one case (the patient is 70 - 79 years old- 1.37%). 6. Adenomatous polyps of the endometrium occurred in a single case in the age category 40-49 (1.37%); 8. The glandular hyperplasia of the endometrium was also noted in a single case at the age of 40 - 49 (1.37%) years; 9. Cervical dysplasia in 1.3% of cases at the age of 50 - 59 years; 10. Uterine fibroids of large size: were presented by the single case at the age of 30-39 years (1.37%) 11. Uterine leiomyoma: 40-49 years old (1.37%). The treatment was carried out by primary tension. The patients were discharged on the 10th - 14th day.

Complications after hysterectomy: the greatest number of complications (12, 43%) was observed in patients belonging to the age group 60 - 69 years (14). Complications after extirpation of the uterus and appendages were presented in 15.71% (11) cases and after the Wertheim surgery in 1.37% (1) cases. The presence of postoperative complications of patients after hysterectomy in all the observations combined with the presence of some concomitant extragenital pathology: diabetes mellitus - 21, 43% (3), hypertension - 28, 57% (4), diabetes mellitus in combination with hypertension - 21, 43% (3), there were also some isolated cases of a combination of disorders of carbohydrate metabolism and disorders of the gastrointestinal tract and the cardiovascular system. The volume of postoperative complications presented 5.5% (4) in the group of patients from 60 to 69 years and 4.1% (3) in the group of 70-79 years. The overwhelming number of patients had postoperative complications in the age group from 60 to 69 years. The patients of the group of 70-79 years old had the complications in 6.81% of cases (5), at the age of 50-59 years- in 9.59% of cases (7) and in the age group from 80-89 in 1, 37% of cases (1) . Concomitant pathology was combined with the presence of postoperative complications in 85.71% (12) cases

Conclusions

1) The highest age leads the higher number of postoperative complications.
2) Some comorbid conditions in the anamnesis cause the increase of postoperative complications.
3) The proper and timely detection and treatment of neoplasms allows to avoid a lot of postoperative complications and improve the women's quality of life.

The research was conducted under the supervision of Cherny Oleg Vladimirovich, Candidate of Medical Sciences, Assistant of the Department of Obstetrics, Gynecology and Perinatology, Kuban medical state university, Krasnodar, Russia

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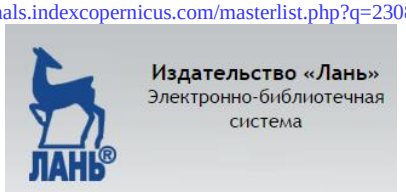

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