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FINDING AND ANALYZING THE ROLLING CHARACTERISTICS OF THE WHEEL ON THE RAIL IN THE PRESENCE OF A VISCOUS INCOMPRESSIBLE INTERMEDIATE MEDIUM

Анотація. *Мета статті – розробка, розв'язок і аналіз математичної моделі руху колеса по рейці за наявності в зоні контакту проміжного середовища. Для визначення характеристик кочення колеса по рейці за наявності проміжного середовища в режимах розгону і гальмування розв'язані рівняння руху в'язкої нестисливої рідини. Задоволення граничним умовам проведено методом зважених відхилів у вигляді поточкової коллокації. На основі проведених розрахунків і аналізу встановлено, що за наявності проміжного середовища в режимах розгону та гальмування відносне ковзання по-різному впливає на коефіцієнт зчеплення коліс з рейками. Результати розрахунків добре узгоджуються з експериментальними даними.*

Ключові слова: *фрикційна пара, коефіцієнт зчеплення, колесо локомотива, рейкова колія, рівняння Навье – Стокса, метод зважених відхилів.*

Аннотация. *Цель статьи – разработка, решение и анализ математической модели движения колеса по рельсу при наличии в зоне контакта промежуточной среды. Для определения характеристик качения колеса по рельсу при наличии промежуточной среды в режимах разгона и торможения решены уравнения движения вязкой несжимаемой жидкости. Удовлетворение граничным условиям проведено методом взвешенных невязок в виде поточечной коллокации. На основе проведенных расчетов и анализа установлено, что при наличии промежуточной среды в режимах разгона и торможения относительное скольжение по-разному влияет на коэффициент сцепления колес с рельсами. Результаты расчетов хорошо согласуются с экспериментальными данными.*

Ключевые слова: *фрикционная пара, коэффициент сцепления, колесо локомотива, рельсовый путь, уравнения Навье – Стокса, метод взвешенных невязок.*

Abstract. *Article purpose – the development, solution and analysis of a mathematical model of the movement of a wheel along a rail in the presence of an intermediate medium in the contact zone. To determine the wheel rolling characteristics along the rail in the presence of an intermediate medium in the acceleration and deceleration modes, the equations of motion of a viscous incompressible fluid are solved. The satisfaction of the boundary conditions was carried out by the method of weighted residuals in the form of pointwise collocation. Based on the calculations and analysis carried out, it was found that in the presence of an intermediate medium in acceleration and deceleration modes, the relative slip affects the coefficient of adhesion of wheels to rails in different ways. The calculation results are in good agreement with the experimental data.*

Keywords: *frictional couple, coupling coefficient, a locomotive wheel, a railway line, Navier – Stokses equations, a method of the weighed discrepancies.*

Steel wheels have relatively stable friction properties and are widely used in rail vehicles and in lifting and transport equipment. The kinematic and dynamic properties of a wheel-rail friction pair are determined by their geometrical parameters, external loads and the presence of an intermediate medium. The rail track in the mines is covered with a significant contaminating fine-dispersed layer, which is a mixture of rock, wear particles of brake pads and wheels in the soil waters. When braking a locomotive, a liquid or multi-dispersed medium located on rails significantly affects the coefficient of adhesion of the wheel to the rail and the rolling resistance force. Currently, the process of interaction of the wheel with the rail in the presence of an intermediate medium has not been studied enough.

In work [1] changes in pressure in the zone of contact between the wheel and the rail were established for various characteristics of the intermediate medium. It is shown that when the load on the wheel of a locomotive moving along a track covered with an intermediate medium changes, the carrying capacity of a viscoplastic medium can reduce the coefficient of adhesion to the magnitude of the internal friction of the medium. In this case, the wheel will be in hydroplaning mode. In work [2] on the basis of the equations of the hydrodynamic theory of greasing interaction of a brake shoe wheel-block brakes with a wheel in the presence of the intermediate environment in the form of dispersion of products of wear of lubricants and inorganic pollution in contact zones a block - a wheel and a wheel - a rail is considered.

Article purpose - development, solution and analysis of a mathematical model of the movement of the wheel along the rail in the presence of an intermediate medium in the contact zone.

These studies are a continuation of [3, 4]. Here, in addition to previous studies, the process of wheel acceleration in the presence of an intermediate medium was considered and a comparative analysis of the friction characteristics in acceleration and deceleration modes was performed. To improve the quality of modeling and refine the results, the number of collocation points was increased to 15, which led to a larger number of equations in the system.

The model of the movement of the Newtonian viscous incompressible liquid [5] is applied to establishment of characteristics of swing of a steel wheel on a rail in the presence of the intermediate environment. To the rotating steel wheel on a normal to a rail force which part is perceived by the intermediate environment is applied. In the course of swing of a wheel it is affected by the moment of dispersal or braking $M_{\text{рт}}$ (fig. 1).

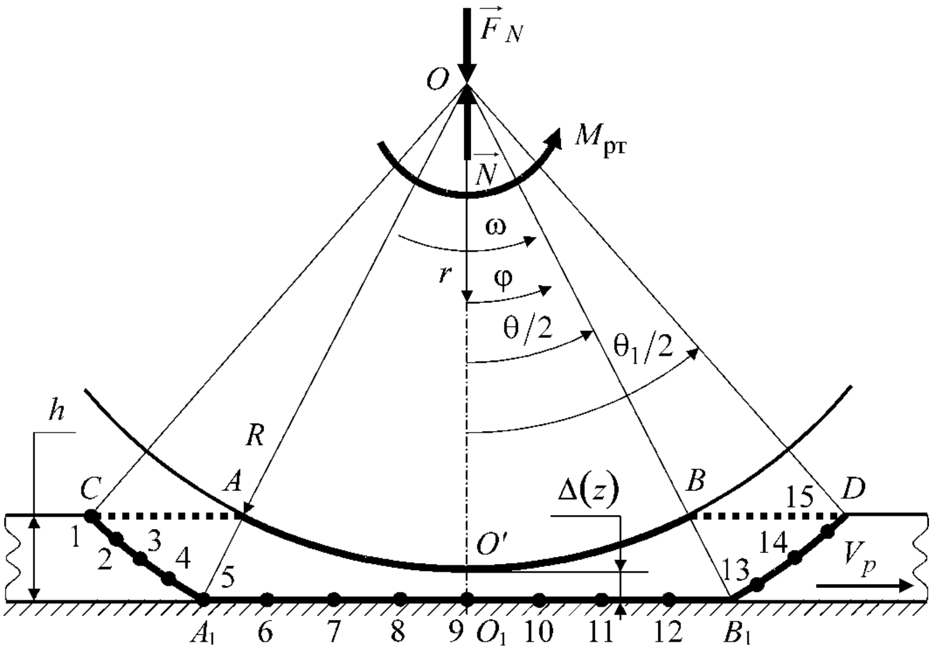

Fig. 1. The rated scheme of the movement of a wheel in the presence of the intermediate environment

In fig. 1 the following designations are accepted: R – radius of a circle of driving of a wheel; ω – angular speed of a wheel; $\vec{F}_N$ – normal force; $\vec{N} = \vec{F}_n + \vec{F}_p$; $\vec{F}_n$ - lifting force of the intermediate environment; $\vec{F}_p$ - reaction of a rail; r – current radius; φ – current angular coordinate; h – thickness of a layer of the intermediate environment; $\Delta(z)$ – the gap between a wheel and a rail in the plane $z = const$ (the axis of Oz is directed perpendicularly to the drawing plane in such a way that if to look from its end, then positive values of angular movements φ are represented occurring against the course of an hour hand) filled with the intermediate environment; V_p – the speed of a rail of rather geometrical center of a wheel equal on absolute value of speed of the locomotive; 1,2,3,…, 15 – collocation points; θ , θ_1 – the corners defined geometrically

$$\frac{\theta}{2} = arccos\frac{R-h+\Delta(z)}{R},$$

$$\frac{\theta_1}{2} = arccos\frac{R-h+\Delta(z)}{OD} = arccos\frac{R-h+\Delta(z)}{OB_1} = arccos\frac{\left(R-h+\Delta(z)\right)cos\frac{\theta}{2}}{OO_1} = arccos\frac{\left(R-h+\Delta(z)\right)^2}{R\left(R+\Delta(z)\right)}.$$

Neglecting "end effects" and believing that the wheel and a rail have infinite length in the direction of a wheel pivot, we will consider that the movement of the intermediate environment in a gap between a wheel and a rail is flat. Thus, the task is reduced to consideration of the movement of viscous incompressible liquid between the wheel rotating with angular speed ω which geometrical center is not mobile and is a pole O of polar system of coordinates, and the rail moving progressively concerning a pole O in the direction of rotation of a wheel with a speed V_p. Rail speed in the mode of dispersal is less than circumferential speed of a wheel, and in the braking mode - exceeds it. Thus, between working surfaces of a wheel and a rail slipping takes place.

Let's use Navier – Stokses equations in polar system of coordinates [5]:

$$\frac{\partial V_r}{\partial t}+V_r\frac{\partial V_r}{\partial r}+\frac{V_\varphi}{r}\frac{\partial V_r}{\partial \varphi}-\frac{V_\varphi^2}{r}=-\frac{1}{\rho}\frac{\partial p}{\partial r}+\nu\left(\nabla^2 V_r-\frac{V_r}{r^2}-\frac{2}{r^2}\frac{\partial V_\varphi}{\partial \varphi}\right);$$

$$\frac{\partial V_\varphi}{\partial t}+V_r\frac{\partial V_\varphi}{\partial r}+\frac{V_\varphi}{r}\frac{\partial V_\varphi}{\partial \varphi}+\frac{V_r V_\varphi}{r}=-\frac{1}{\rho}\frac{1}{r}\frac{\partial p}{\partial \varphi}+\nu\left(\nabla^2 V_\varphi+\frac{2}{r^2}\frac{\partial V_r}{\partial \varphi}-\frac{V_\varphi}{r^2}\right);$$

$$\frac{\partial (rV_r)}{\partial r}+\frac{\partial V_\varphi}{\partial \varphi}=0; \qquad \nabla^2\equiv\frac{\partial^2}{\partial r^2}+\frac{1}{r}\frac{\partial}{\partial r}+\frac{1}{r^2}\frac{\partial^2}{\partial \varphi^2},$$

where V_r – a velocity vector projection in the direction of the current radius; V_φ – a velocity vector projection in the direction of the current angular coordinate; t – time; ρ – liquid density; p – pressure; ν – kinematic coefficient of viscosity.

The gap between a wheel and a rail is very small in comparison with wheel radius R. We will consider the movement of liquid in a gap slow as inertial members in comparison with the members considering viscous forces and change of pressure can be neglected. Then the linearized Navier – Stokses equations in which there are no inertial members in polar coordinates will take the following form

$$\mu\frac{\partial^2 V_\varphi}{\partial r^2}=\frac{1}{r}\frac{\partial p}{\partial \varphi},\ \mu\frac{\partial^2 V_r}{\partial r^2}=\frac{\partial p}{\partial r},\ \frac{\partial V_r}{\partial r}+\frac{1}{r}\frac{\partial V_\varphi}{\partial \varphi}=0, \tag{1}$$

where $\mu=\nu\rho$ – the dynamic coefficient of viscosity of liquid depending on temperature.

By drawing up these equations the relative trifle of a gap in comparison with wheel radius allowing to consider that is considered

$$V_\varphi \gg V_r; \qquad \frac{\partial^2 V_\varphi}{\partial r^2}\gg\frac{1}{r}\frac{\partial V_\varphi}{\partial r},\ \frac{1}{r^2}\frac{\partial^2 V_\varphi}{\partial \varphi^2},\ \frac{1}{r^2}\frac{\partial V_r}{\partial \varphi},\ \frac{V_\varphi}{r^2};$$

$$\frac{\partial^2 V_r}{\partial r^2}\gg\frac{1}{r}\frac{\partial V_r}{\partial r},\ \frac{1}{r^2}\frac{\partial^2 V_r}{\partial \varphi^2},\ \frac{1}{r^2}\frac{\partial V_\varphi}{\partial \varphi},\ \frac{V_r}{r^2}; \qquad \frac{\partial V_r}{\partial r}\gg\frac{V_r}{r}; \qquad \frac{\partial^2 V_r}{\partial r^2}\ll\frac{\partial^2 V_\varphi}{\partial r^2}.$$

Follows from the first two equalities of system (1) that

$$r\frac{\partial p}{\partial r}\ll\frac{\partial p}{\partial \varphi}.$$

It allows to accept further

$$\frac{\partial p}{\partial r}=0,\ p=p(\varphi).$$

Besides, in system of the equations (1) it is possible to replace out of a derivative sign r on R, and from a variable r $\left(R\le r\le (R+\Delta(z))/cos\ (\theta/2)\right)$ to pass to the variable $\zeta=r-R$ changing in an interval $0\le\zeta\le (R+\Delta(z))/cos\ (\theta/2)-R$. Then $\partial/\partial r=\partial/\partial\zeta$ and Navier – Stokses equations will register so:

$$\mu\frac{\partial^2 V_\varphi}{\partial \zeta^2}=\frac{1}{R}\frac{dp}{d\varphi}; \qquad \frac{\partial V_r}{\partial \zeta}=-\frac{1}{R}\frac{\partial V_\varphi}{\partial \varphi}. \tag{2}$$

Normal σ_{rr} and tangent $\tau_{r\varphi}$ stresses according to the generalized law of Newton for incompressible viscous liquid in expanded form in polar system of coordinates according to work [5] are determined by formulas

$$\sigma_{rr} = -p + 2\mu \frac{\partial V_r}{\partial \zeta}; \qquad \tau_{r\varphi} = \mu \left(\frac{1}{R} \frac{\partial V_r}{\partial \varphi} + \frac{\partial V_\varphi}{\partial \zeta} - \frac{V_\varphi}{R} \right). \tag{3}$$

Let's find distribution $V_\varphi = V_\varphi(r,\varphi)$ $V_r = V_r(r,\varphi)$, $p = p(\varphi)$ in the $CABDB_1A_1$ area belonging to the plane $z = const$ (fig. 1).

At the solution of the specific objectives connected with a flow of firm surfaces viscous liquid boundary conditions have to be used [5]: particles of liquid "stick" to a firm wall, without getting through it, and in a common ground of their speed match speeds of points of a moving firm surface; on removal from a streamline body the speed and pressure, in any point of a flow are set.

Let's write down boundary conditions taking into account that environment speed on border medium - a wheel is equal to wheel speed, on border medium - a rail is equal to rail speed; medium does not get through borders; on removal from a wheel the speed of the environment is equal to rail speed, pressure is equal to zero. Thus:

at $\zeta = 0$, $|\varphi| < \theta/2$ *($AO'B$ line)*

$$V_\varphi = \omega R = V_p (S+1), \qquad V_r = 0, \tag{4}$$

where $S = \dfrac{\omega R - V_p}{V_p}$ – relative sliding of a wheel on a rail;

at $\zeta = \dfrac{R + \Delta(z)}{cos\,\varphi} - R$, $|\varphi| < \theta/2$ (line A_1B_1)

$$V_\varphi = V_p\, cos\,\varphi, \qquad V_r = V_p\, sin\,\varphi; \tag{5}$$

at $\zeta = \dfrac{(R + \Delta(z))}{cos\;(\theta/2)} - R$, $\theta/2 < |\varphi| < \theta_1/2$ (line CA_1 and B_1D)

$$V_\varphi = V_p\, cos\,\varphi, \qquad V_r = V_p\, sin\,\varphi, \qquad p = 0. \tag{6}$$

The approximation of the decision satisfying to Navier – Stokses equations (2) and to boundary conditions (4) it is identical, we will choose in a look

$$\left.\begin{aligned} V_\varphi &= \omega R + \left(a\zeta - \zeta^2\right) \left(\sum_{i=1}^{n} a_i\, cos \frac{2i\varphi\pi}{\theta_1} + \sum_{i=1}^{k} b_i\, sin \frac{2i\varphi\pi}{\theta_1} \right); \\ V_r &= \frac{2\pi}{R\theta_1} \left(\frac{\zeta^3}{3} - \frac{a\zeta^2}{2} \right) \left(-\sum_{i=1}^{n} a_i i\, sin \frac{2i\varphi\pi}{\theta_1} + \sum_{i=1}^{k} b_i i\, cos \frac{2i\varphi\pi}{\theta_1} \right) + f(\varphi); \\ p &= -\frac{\mu R \theta_1}{\pi} \left(\sum_{i=1}^{n} \frac{a_i}{i} sin \frac{2i\varphi\pi}{\theta_1} - \sum_{i=1}^{k} \frac{b_i}{i} cos \frac{2i\varphi\pi}{\theta_1} \right), \end{aligned}\right\} \tag{7}$$

where $a = \Delta(z) \left(1 - \dfrac{2}{\pi} arctq\, S \right)$; $f(\varphi) = \begin{cases} V_p\, sin\left(\theta_1 (\varphi + \theta/2) / (\theta_1 - \theta)\right), & \text{at} \quad -\theta_1/2 \le \varphi < -\theta/2; \\ 0, \quad \text{at} \quad |\varphi| \le \theta/2; & \\ V_p\, sin\left(\theta_1 (\varphi - \theta/2) / (\theta_1 - \theta)\right), & \text{at} \quad \theta/2 < \varphi \le \theta_1/2. \end{cases}$

We will also define unknown coefficients a_i and b_i so that the chosen approximation of the decision met boundary conditions (5), (6). For satisfaction of functions V_φ and V_r to boundary conditions (5) and (6), and also function p to a boundary condition (6) we will use method of the weighed discrepancies in the form of a pointwise collocation [6]. We will choose points of a collocation on the CA_1B_1D line asymmetrically rather direct $\varphi = 0$.

From system of the equations (7) we have

$$\sum_{i=1}^{n} K_{ji} a_i + \sum_{i=1}^{k} M_{ji} b_i = L_j \ , \qquad (8)$$

where $K_{ji} = cos\frac{2i\varphi_j\pi}{\theta_1}$, $M_{ji} = sin\frac{2i\varphi_j\pi}{\theta_1}$, $L_j = \frac{V_p\left(cos\,\varphi_j - S - 1\right)}{a\zeta_j - \zeta_j^2}$ – for the first equation of system (7); $K_{ji} = -i\,sin\frac{2i\varphi_j\pi}{\theta_1}$, $M_{ji} = i\,cos\frac{2i\varphi_j\pi}{\theta_1}$, $L_j = \frac{R\theta_1\left(V_p\,sin\,\varphi_j - f\left(\varphi_j\right)\right)}{2\pi\left(\frac{\zeta_j^3}{3} - \frac{a\zeta_j^2}{2}\right)}$ – for the second equation of system (7); $K_{ji} = \frac{1}{i}sin\frac{2i\varphi_j\pi}{\theta_1}$, $M_{ji} = -\frac{1}{i}cos\frac{2i\varphi_j\pi}{\theta_1}$, $L_j = 0$ – for the third equation of system (7); $\zeta_j = \frac{R + \Delta(z)}{cos\,\varphi_j} - R$ on the line A_1B_1; $\zeta_j = \frac{R + \Delta(z)}{cos\ (\theta/2)} - R$ on lines CA_1 и B_1D; $j = 1, 2, 3, ..., m$ (m – total quantity of the equations of system (8)).

The total number of unknown a_i and b_i has to be equal in system of the linear algebraic equations (8) to number of the equations. Thus, the number of members of ranks in decomposition (7) depends on quantity of points of a collocation. For carrying out numerical calculations we will take 15 points of a collocation. Points on an entrance to the $CABDB_1A_1$ area we will arrange more densely, than at the exit (fig. 1). Then the system (8) will consist of thirty eight equations and it is possible to accept $n = 19$, $k = 19$. Considering $R = f(z) = const$, $\Delta(z) = const$, we will determine the carrying power of the intermediate environment and force of the viscous resistance caused by existence of the intermediate environment as functions of relative sliding on formulas

$$F_n = b\int_{AB} \sigma_{rr}\,cos\,\varphi\,dl = \frac{b\mu R^2\theta_1^2}{\pi}\sum_{i=1}^{n}\frac{b_i}{i}\left(\frac{1}{2i\pi - \theta_1}sin\frac{(2i\pi - \theta_1)\ \theta}{2\theta_1} + \frac{1}{2i\pi + \theta_1}sin\frac{(2i\pi + \theta_1)\ \theta}{2\theta_1}\right); \qquad (9)$$

$$F_c = b\int_{AB} \tau_{r\varphi}\,cos\,\varphi\,dl = bR\mu\left(a\,\theta_1\sum_{i=1}^{n} a_i\left(\frac{1}{2i\pi - \theta_1}sin\frac{(2i\pi - \theta_1)\ \theta}{2\theta_1} + \frac{1}{2i\pi + \theta_1}sin\frac{(2i\pi + \theta_1)\ \theta}{2\theta_1}\right) + 2\omega\,sin\frac{\theta}{2}\right), \qquad (10)$$

where b – width of a zone of contact of a wheel and intermediate environment; $dl = \sqrt{r^2 + r'^2}d\varphi = Rd\varphi$ – curve arch differential.

The decision of system of the linear algebraic equations (8) was executed by the Gauss method for the sizes of relative sliding changing in the range from minus units (the skid mode) to two (slipping drafts in the mode with the district speed of a wheel three times exceeding rail speed concerning a wheel). Further taking into account formulas (9) and (10) the relative carrying power of the intermediate environment $F_n^* = F_n / F_N$, the relative force of viscous resistance caused by existence of the intermediate environment $F_c^* = F_c / F_N$ and the relation of increase in relative carrying power to increase in relative force of viscous resistance in comparison with values of these sizes at free swing were found $F_n^* = F_n / F_N$ $F_c^* = F_c / F_N$

$$F_\Delta^* = \frac{F_n^*(S) - F_n^*(0)}{F_c^*(S) - F_c^*(0)}$$

as functions of relative sliding at the following input datas: $R = 0{,}27$ m ; $V_p = 5$ m/s ; $h = 5 \cdot 10^{-3}$ m ; $\Delta(z) = 10^{-3}$ m ; $b = 5 \cdot 10^{-2}$ m ; $F_N = 1{,}25 \cdot 10^4$ N ; $\mu = 5{,}214$ $\text{N} \cdot \text{s}/\text{m}^2$. Calculations were carried out by means of a standard package of the application programs "Mathematica 7.0" for 15 points of a collocation (fig. 1). Increase in number of points of a collocation (more than 15) significantly will not influence the decision as even at nine points of a collocation [3] difference of the decision does not exceed 7%. It speaks about good convergence of ranks (7).

From fig. 2 it is visible that dependences of relative carrying power and relative force of viscous resistance increase with increase $|S|$. And, on an interval $0 < |S| < 0{,}05$ increase of function $F_c^* = F_c^*(S)$ reaches bigger size, than function increase $F_n^* = F_n^*(S)$. At the relative sliding, equal $\pm 0{,}05$, function $F_\Delta^* = F_\Delta^*(S)$ has minima ($F_{\Delta\ min}^* = 0{,}62$ and $F_{\Delta\ min}^* = 0{,}64$ respectively). On an interval $0{,}05 < |S| < 0{,}2$ the function graph $F_n^*(S)$ has significantly sharper rise, than a function graph $F_c^*(S)$. On this interval of value of function $F_\Delta^*(S)$ increase in the braking mode by 5,6 times (with 0,64 to 3,60), passing through unit at $S = -0{,}085$ and in the dispersal mode - by 6,2 times (with 0,62 to 3,87), passing through unit at $S = 0{,}085$. It promotes reduction of an absolute value of coefficient of coupling ψ . Further, at $0{,}2 < |S| < 1$ value of function $F_\Delta^*(S)$ changes slightly and makes about 3,65 in the mode of braking and 3,9 in the dispersal mode. At $1 < S < 2$ value of function $F_\Delta^*(S)$ it is approximately equal to 3,85. Function $F_\Delta^*(S)$ at $0 < |S| < 0{,}1$ in the mode of dispersal accepts smaller values, than in the braking mode, and at $0{,}1 < |S| < 1$ on the contrary - great values.

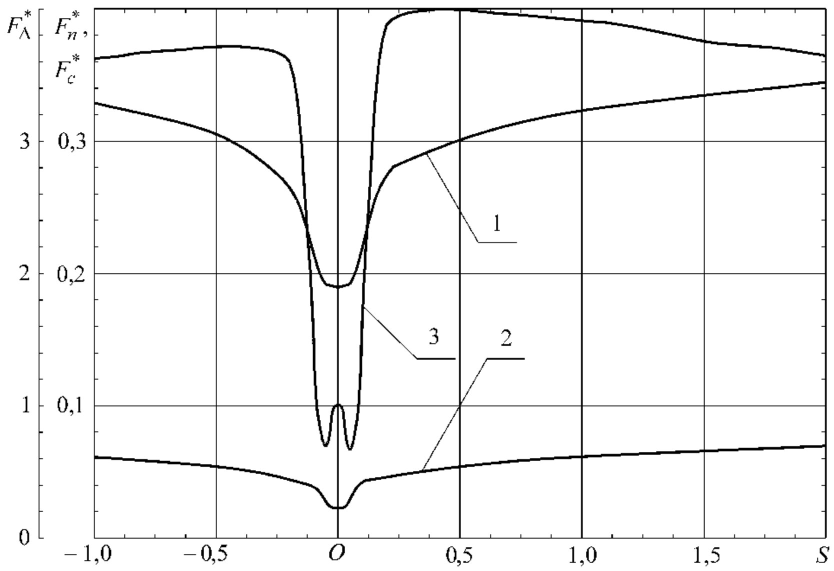

Fig. 2. Dependences of relative carrying power and relative force of viscous resistance on relative sliding: 1 – relative carrying power F_n^* ; 2 – relative force of viscous resistance F_c^* ; 3 – relation of increase in relative carrying power to increase in relative force of viscous resistance F_Δ^*

Conclusions

1. On the basis of the carried-out calculations and the analysis it is established that in the presence of the intermediate environment in the modes of dispersal and braking relative sliding differently influences coefficient of coupling of wheels with rails;

2. For stabilization of coefficient of coupling ψ during dispersal and braking in the presence between a wheel and a rail of the intermediate environment it is necessary to limit absolute value of relative sliding of 8,5%.

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СРАВНИТЕЛЬНЫЙ АНАЛИЗ РЕЗУЛЬТАТОВ МОДЕЛИРОВАНИЯ ЭЛЕКТРОМЕХАНИЧЕСКИХ СИСТЕМ «ЭЛЕКТРИЧЕСКАЯ СЕТЬ – ПРИВОД – КОМПРЕССОР – ПНЕВМОСЕТЬ» РАЗЛИЧНОЙ ПРОИЗВОДИТЕЛЬНОСТИ

Анотація. *В роботі проведено порівняльний аналіз результатів моделювання математичної моделі, що дозволяє визначати оптимальний режим роботи системи виробництва і розподілу стислого повітря, що складається з наступних елементів "електрична мережа - привід - компресор - пневмомережа". Проведений аналіз показав, що пропонований варіант регулювання з «плаваючим» верхнім рівнем тиску, для систем різної продуктивності, забезпечує скорочення витрат електричної енергії, що споживаються розглянутими електромеханічними системами. Економія може досягати 13,5% в залежності від значень витрати стислого повітря, споживаного пневмоприймачів, продуктивності компресора і параметрів електромеханічної системи.*
Ключові слова: *електропривод, регулювання, компресор, електромеханічна система.*

Аннотация. *В работе проведен сравнительный анализ результатов моделирования математической модели, позволяющей определять оптимальный режим работы системы производства и распределения сжатого воздуха, состоящей из следующих элементов "электрическая сеть – привод – компрессор – пневмосеть". Проведенный анализ показал, что предлагаемый вариант регулирования с «плавающим» верхним уровнем давления, для систем различной производительности, обеспечивает сокращение расхода электрической энергии, потребляемыми рассматриваемыми электромеханическими системами. Экономия может достигать 13,5 % в зависимости от значений расхода сжатого воздуха, потребляемого пневмоприемниками, производительности компрессора и параметров электромеханической системы.*
Ключевые слова: *электропривод, регулирование, компрессор, электромеханическая система.*

Abstract. *A comparative analysis of the simulation results of a mathematical model, which allows to determine the optimal mode of operation of the compressed air production and distribution system, consisting of the following elements "electric network - drive - compressor - pneumatic network", is carried out. The analysis showed that the proposed control option with a "floating" upper pressure level, for systems of various capacities, provides a reduction in the electrical energy consumption consumed by the electromechanical systems under consideration. Savings can reach 13.5% depending on the values of compressed air consumption consumed by pneumatic receivers, compressor performance and parameters of an electromechanical system.*
Keywords: *electric drive, control, compressor, electromechanical system.*