When the iterative calculations are completed, the derived parameters ρ_i, l_i, S_i, ω_i are taken and forces and velocity values are determined.

To sum up, a modeling algorithm of a propelling motor drag resistance should take into account the whole set of drag resistances as well as traction performance of electric motors of driving track bogies.

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MATHEMATICAL MODEL FOR CONTACT RESISTANCE OF COLD CONTACT AT SPOT WELDING

The paper is devoted to the problem of optimizing spot welding modes and contains the description of a mathematical model for the calculation of cold contact initial resistance.

Keywords: spot welding, resistance of cold contact.

The practice of spot welding and the numerous results of published researches unambiguously confirm that one of main conditions of forming quality-welded joints is the optimality of the initial resistance of part -to- part $r_{\text{КТ}}$ contact. Its value and stability essentially influences the sizes of a kernel, the stability of the process against creating splashes and poor penetration. At the same time, until now, the development of spot welding technologies of $r_{\text{КТ}}$ value had been achieved experimentally for each particular welding condition; this is rather labor-intensive.

According to the conducted research it has been concluded that the rod model is the most acceptable engineering technique among all known methods applied in rough surface models for welded contacts; mainly because it describes the mechanism of contact interaction between two rough surfaces with more simplicity and precision (fig. 1).

According to the accepted model of two rough surface contacts, the conductivity in the contact layer is carried out according to n_r number of individually parallel micro conductors of d ($d \to 0$) diameter, and of a length, formed by deformable rods (micro lugs). One of the constituents of the total electric resistance in such a micro contact $r_{\text{КТ}}$ which is caused by the resistance of micro conductors in the contact layer, which has properties different to those of parent metal, is called the internal contact resistance $r_{\text{КВ}}$. The other part, which is formed by current line curvatures j in near contact areas where properties of the parent metal are assumed to not change, is called the micro geometrical contact resistance $r_{\text{МГ}}$. Then the total electric resistance contact will be equal to the sum of these two components:

$$r_{\text{КТ}} = r_{\text{КТ}} + r_{\text{КТ}}.$$

The total internal electric contact resistance $r_{\text{ВН}}$ can be defined in the following manner:

$$r_{\text{ВН}} = \frac{r_{\text{ВН}}}{n_r} = \rho_\Delta \frac{a}{n_r \Delta S} = \rho_\Delta \frac{2R_{\max}(1-\varepsilon)}{A_r}.$$

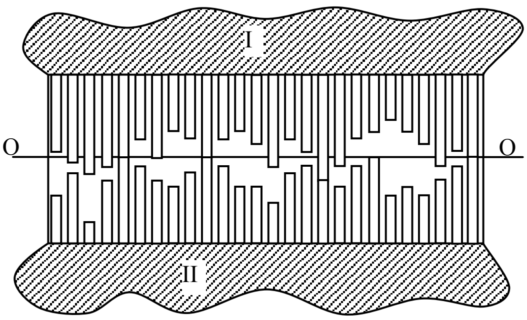

Fig. 1. Contact of two rough surfaces. The rod model

For the accepted model, the micro geometrical resistance for individual contact $r^*_{\text{МГ}}$ can be defined according to the familiar dependence, considering its presence in two parts (fig. 2):

$$r_{\text{МГ}} = 2\rho\left(\frac{1}{d} - \frac{1}{D}\right).$$

The total micro geometrical contact resistivity $r_{\text{МГ}}$ can be defined accepting the following dependence:

$$r_{\text{МГ}} = \frac{r_{\text{МГ}}}{n_r} = \frac{2\rho}{n_r}\left(\frac{1}{d} - \frac{1}{D}\right).$$

To calculate $r_{\text{ВН}}$ and $r_{\text{МГ}}$ it is necessary to define the mechanical parameters of the welded contact and first of all, define the deformation the micro lugs undergo:

whether they are elastic or plastic. This may be done by comparing the pressure σ_{CP} operating the in contact outline area, and the critical pressure σ_K at which the contact transforms to a plastic state.

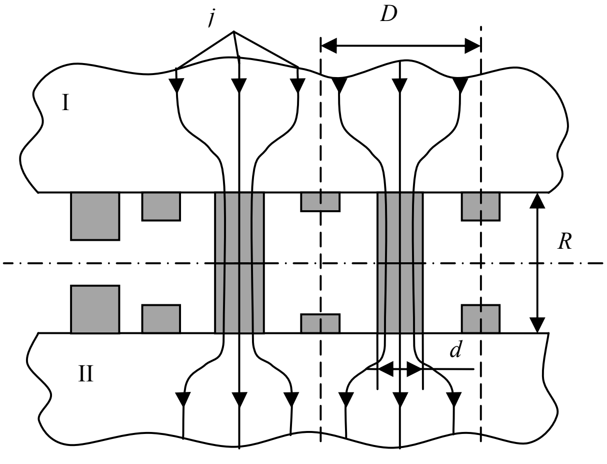

Fig. 2. Contact conductivity in the rod model

The comparison of σ_{CP} and σ_K values at static electrode force defined by the practice of spot welding modes for parts with a thickness of 0.5–4 mm for various steels and alloys shows that the micro roughness in the welded contacts always deforms plastically. For example, at a change R_{max} within 2.4–37 µm the values σ_K / σ_{02} and $\sigma_{CP} / \sigma_{02}$ (in brackets) at spot welding of parts with a thickness of 0.5–4 mm made of 08 and 12X18P10E type steels, and a AMг6 alloy change within: $2\cdot10^{-6}$–0,03 (1.6–1.9), $1,2\cdot10^{-5}$–0.02 (1.8–2.7) и $2.5\cdot10^{-5}$–0.4 (1.8–2.9) accordingly. For comparing plastic and elastic contacts the problem of its mechanical parameter definition is considerably simplified; the actual area of the contact depends only on surface's micro geometry, and the rapprochement depends only on the material distribution within the rough layer (fig. 3). For these conditions, value ε can be defined applying the dependence:

$$\varepsilon = \left(\frac{\sigma_{CP}}{C_\varepsilon \cdot \sigma_{02} \cdot b} \right)^{\frac{1}{v}},$$

where C_ε is the factor considering the metal hardening in micro roughness at its plastic deformation; b, v are the parameters of a basic curve b_1, v_1 that are defined by the contacting of two equally rough surfaces according to the formula:

$$b = k_{v_{1,2}} \cdot 2^{v_1} \cdot b_1^2,\ v = 2 \cdot v_1 .$$

The number of micro contacts n_r and their average diameter d can be defined from the following ratio:

$$n_r = \frac{A_r}{\Delta \overline{S}} = \frac{A_C * \eta}{2\pi\, \Theta\varepsilon},$$

$$d = \sqrt{\frac{4\Delta A_C}{\pi}} = 2\sqrt{2\Theta\,\varepsilon}.$$

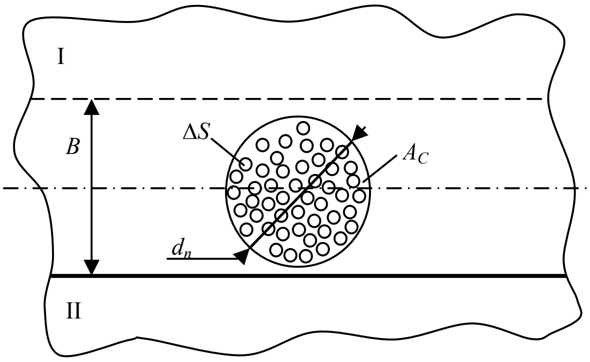

Fig. 3. Model of sieve contact conductivity

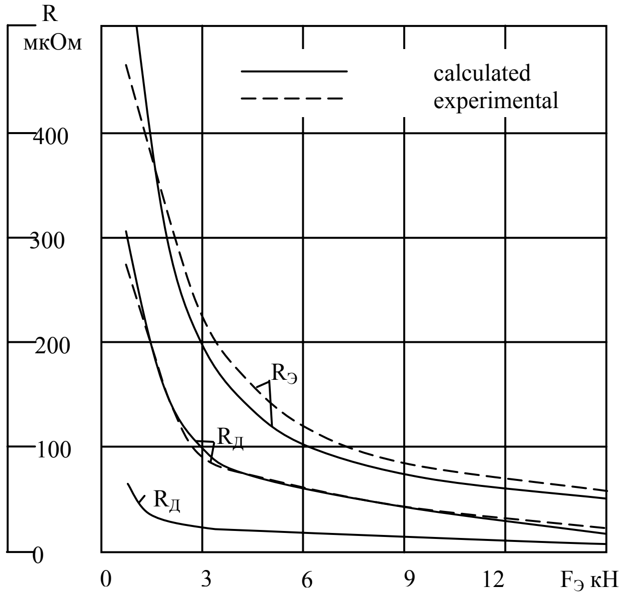

Fig. 4. Results of experimental and calculated resistance values

The average value of the current line spread area from an individual micro conductor can be defined as the area of contacting micro roughness to a number of micro contacts:

$$\Delta A_C = \frac{A_C}{n_r}$$

and its diameter d according to the following dependence:

$$D = \sqrt{\frac{4\Delta A_C}{\pi}} = 2\sqrt{\frac{2\Theta\,\varepsilon}{\eta}} .$$

Using the results of the researches, studying contact resistance and carrying out reasonable calculations, we have obtained a dependence to calculate the resistance of the welded contact (fig. 4):

$$r_{KT} = \rho_\Delta \frac{2\sigma_{CP} R_{max}(1-\varepsilon)}{F_Э\, \eta} + \rho \frac{\pi\sigma_{CP}\sqrt{2\Theta\,\varepsilon}}{2F_Э \eta}\left(1-\sqrt{\eta}\right).$$

To define it we need to experimentally measure the value r_{KT} at any $F_Э$ (it is best to measure r_{KT} at $F_Э$ as closely to the recommended spot welding area as possible), and then to calculate value ρ_Δ according to the following dependence:

$$\rho_\Delta = \frac{F_Э \eta}{2\sigma_{CP} R_{max}(1-\varepsilon)} \times$$

$$\times \left(r_{KT} - \rho \frac{\pi\sigma_{CP}\sqrt{2\Theta\,\varepsilon}}{2F_Э\eta}\left(1-\sqrt{\eta}\right) \right).$$

The developed mathematical model describes, with sufficient accuracy, the action of electric resistance in part-to-part contact, which is testified by experimental and calculated values of this resistivity [1–4].

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THE REALIZATION OF A MECHANISM FOR RECEPTION DIVERSITY IN THE HYBRID FIBER OF WIRELESS INFORMATION TRANSFER

In this article we have considered the possibilities of realizing diversity reception algorithms in hybrid fibers of wireless information transfer. At the heart of diverse reception algorithms lies the fact that when solving problems of optimal field processing, their correlation curves are definite for the description of the Gauss and any kind of stochastic fields.

Keywords: a hybrid fiber of wireless information transfer, algorithm of diversity reception, correlation factor, optimal reception.

The further development of information transfer in wireless networks (ITWN) consists in the provision of reaching subscribers with various telecommunication services in the principle: “anywhere, everything, when necessary”. It is possible to solve the problem of construction networks of such kind basing on the principle of standards convergence, providing compatibility in the management objectives. International standards, reports, and recommendations, which specify the physical level of access management (MAC): IEEE 802.15, 11, 16, 20, 21 cellular and decameter radio communications, are developed in order to provide effective performance in wireless networks. The application of the given standards allows building hybrid networks for wireless information transfer (HNWIT). For this purpose it is necessary to solve a set of problems; one such problem is the application of diversity reception in HNWIT.

The application of diversity signal reception in radio channels is an effective way of increasing communication reliability in conditions of signal fading and the presence of additive hindrances [1–8]. The greatest interest is in the space diversity of signal reception, which consists in reception on different antennas. For HNWIT it is possible to consider the following ways of space diversity: reception on different antennas at one base station in a cellular; reception on antennas with different base stations in a cellular operator area; reception on antennas of interconnected radio centers – repeaters of the radio communication network of a decameter range [9–14]. The realization of these is shown in fig. 1.

The realization of carried reception algorithms demands developing a multiband switch, which depending on the user’s inquiries on the transferred information service quality in a network, will perform the connection of the subscriber to corresponding networks. The complexity of this problem’s solution consists in the mobile subscriber’s equipment. Therefore, an ideal way of realizing the HNWIT substantive provisions is by wireless aeronautical telecommunication (WATC). The primary target of WATC is providing information interchange maintenance between air traffic control points and aircraft situated in their responsibility zones. The solution of given WATC problems are realized by DCM networks, radio communication VHF, and satellite communication network. In order to organize this network structure, the air traffic control points and the aircraft is equipped with necessary means of radio communication.

The aeronautics air communication (AAC) for air traffic control around the airdrome is regulated and organized according to the scheme of air traffic control accepted for the given airdrome.