ISSN NO: 2770-2936
Date of Publication:08-01-2022

Calculation Of Parameters Of Moving Electromagnetic Screen Displacement Converters

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Annotation: The article discusses the sequence of determining the size and parameters of moving screen and scattered parametric magnetic systems and when the inductive resistance of the moving screen was selected to be 20 ÷ 30 times greater than the active resistance, it was found that the errors in the calculations performed on the magnetic systems of the moving screen shift converters did not exceed 5 ÷ 10%.

Keywords: moving screen, magnetic system, inductive resistance, magnetic flux, excitation coil.

Determining the basic sizes of a magnetic circuit, taking into account the active resistance of the magnetic core and the screen in scattered parameter and moving screen converters, poses some difficulties. In the below $R_{eм} \approx 0$ and $Z_{\mu} \approx 0$ a simplified calculation method is considered for scatter parameter and excited electromagnetic screen transducers operating in salt-based mode. In this case the voltage of the excitation coil $U_{eм}$, while $I_{м}$ and frequency f and the sensitivity of the converter $S_{и}$, measured displacement range $\pm X_{м}$ are given as given quantities.

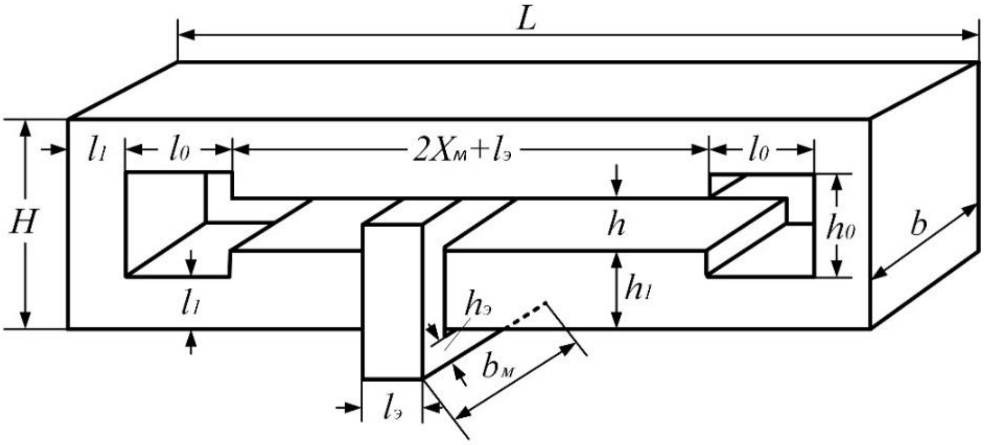

Figure 1. Dimensional dimensions of a dispersed parametric driven electromagnetic screen displacement converter

The calculation of dispersed parameter and movable electromagnetic screen displacement converters is performed in the following sequence:

1. Maximum induction in the cross section of a magnetic conductor long rod $B_{\max}$ The maximum magnetic flux in the steel core is determined as follows:

$$Q_{\mu\max} = B_{\max} b h_1, \qquad (1)$$

or air gap induction B_{h} The maximum magnetic flux in the steel core is determined as follows:

$$Q_{\mu\max} = 2 B_{h} X_{м} b k_{h1}, \qquad (2)$$

here $k_{h1} = 1{,}5$ or the size of the magnetic conductor k_{h1} is determined using curves representing the coefficient dependence.

Using expressions 1 and 2 h_1 the size of is determined as follows:

ISSN NO: 2770-2936
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$$h_1 = \frac{B_h}{B_{max}} 2X_м k_{h1}. \qquad (3)$$

Typically for scattered parameter and moving screen magnetic chains B_{max} and B_h the values of the inductions are selected in the following intervals: $B_{max} = 1 \div 2$ Тл and $B_h = 0{,}05 \div 0{,}1$ Тл.

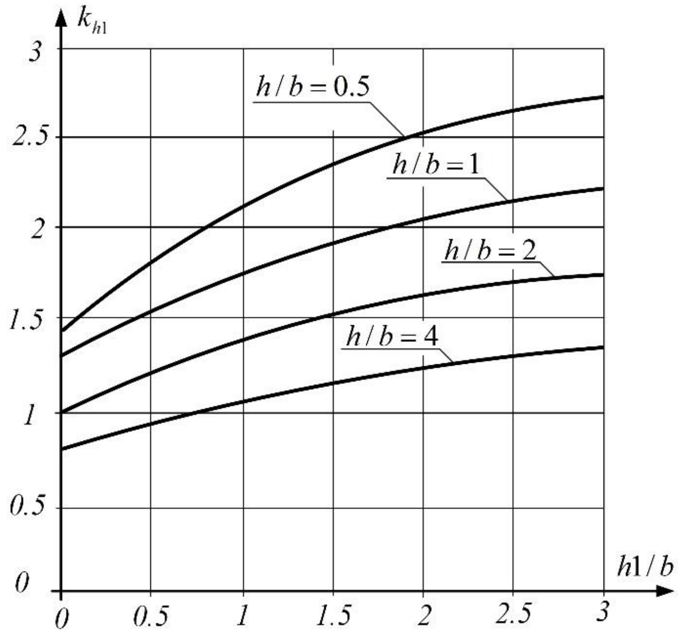

Figure 2. Dimensions of the magnetic conductor k_{h1} graph of coefficient dependence

2. Movable electromagnetic screen size h_e and the size of the magnetic conductor rod h_1 It is advisable to choose the relationship between:

$$\frac{h_1}{h_e} = 1 \div 3.$$

The distance between the long rods h the height of the moving screen in order to increase the accuracy of the calculation of the size of h_e will suffice to select equal to the value of.

3. The maximum value of the magnetic flux through the excitation current can also be determined using the following expression:

$$Q_{max} = I_м w_м C_{\mu п} X_м. \qquad (4)$$

Using expressions 1 and 4, the expression that determines the number of windings of the excitation loop is given:

$$w_м = \frac{B_h 2b k_{h1}}{I_м C_{\mu п}}.$$

The voltage of the excitation coil is determined by the following expression:

$$U_{ем} = I_м \omega w_м^2 C_{\mu p} X_м, \qquad (5)$$

$$U_{ем} = \frac{\omega B_h^2 4b^2 k_{h1}^2 X_м}{I_м C_{\mu п}}.$$

The value of specific magnetic permeability $C_{\mu p} = \frac{\mu_0 b}{h} k_{h1}$ Given that it is determined by the expression, the voltage of the excitation coil is written as follows:

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$$U_{ем} = \frac{\omega B_h^2 4bk_{h1}^2 X_м h}{I_м \mu_0}.$$

Using this expression, the size of the magnetic field width b is determined as follows:

$$b = \frac{U_{ем} I_м \mu_0}{\omega B_h^2 4k_{h1}^2 X_м h}.$$

4. The number of windings of the excitation winding is determined as follows:

$$w_м = \sqrt{\frac{U_м}{I_м \omega C_{\mu p} X_м}}.$$

5. Based on the material of the excitation coil conductor, the surface area of the excitation coil is determined as follows:

$$S_м = \frac{\pi d_м^2 w_м k_з}{4},$$

where the diameter of the conductor is determined using the following expression:

$$d_м = \sqrt{\frac{4I_м}{\pi j}},$$

In there j - current density for conductive material (for copper wire) $j = 4 \div 5$ А/мм^2 the value in the range is assumed).

6. The sensitivity of a scatter parameter and a moving electromagnetic screen converter is determined using the following expression:

$$S_i = 2I_м w_м C_{\mu п} w_i \omega.$$

The number of packages of the measuring cup is determined as follows: $w_i = \frac{S_i}{2I_м w_м C_{\mu p}\omega}$.

7. If the diameter of the excitation coil wire is chosen to be equal to the diameter of the measuring coil wire, the surface area occupied by the coils is determined as follows:

$$S_0 = \frac{\pi d_м^2 k_з}{4}(w_м + w_i),$$

In this place $k_з$ - filling coefficient, $k_з = 0{,}8 \div 0{,}9$.

8. Typically, the largest spacing between long rods is selected as follows:

$$h_0 = h + h_1;$$

$$l_0 = \frac{S_0}{h_0};$$

$$l_1 = \frac{h_1}{2}.$$

When choosing the size of the moving electromagnetic screen, its inductive resistance is chosen to be very large relative to the active resistance.

$$\frac{S_e(2b + 2h + 2h_1)}{hl_e Z_\mu 2X_м} = \frac{1}{20 \div 30},$$

$$l_e = \frac{2S_e(b + h + h_1)}{2hZ_\mu X_м}(20 \div 30).$$

If the inductive resistance of the moving screen is selected to be 20 ÷ 30 times greater than the active resistance, the errors in the calculations performed on the magnetic systems of the scattering parameter and the displacement screen shift variables do not exceed 5 ÷ 10%.

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