Value k_{ec} depends on speed, for example, at $V = 200$ km/h $k_{ec} = 1.21$, at $V = 800$ km/h – $k_{ec} = 1.5$.

Using the algorithm described above, we will determine the sizes and MPD of an electromagnet for $F_{lcalc} = 40{,}5 \cdot 10^3$ N,that will provide the required force of a levitation $F_l = 30 \cdot 10^3$ N.

On the thirteenth iteration parameters of an electromagnet of the minimum mass $M_{em} = 344$ kg are determined providing magnetic induction in a gap of an electromagnet $B_\delta = 0.7$ T (fig. 3) and levitation force $F_л = 40.5$ kN with the set error: $a^{(13)} = 0.091$ m; $iw^{(13)} = 16990$ A; $h^{(13)} = 0.064$ m; $l^{(13)} = 0.127$ m; $b^{(13)} = 0{,}328$ m.

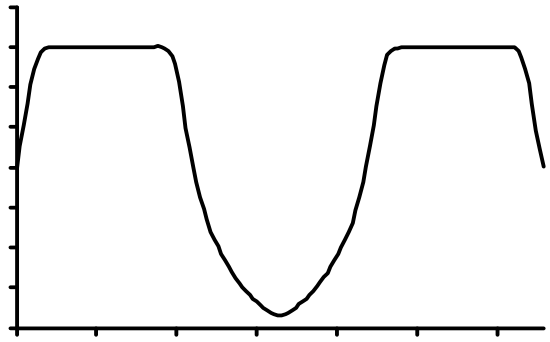

Fig. 3. Distribution of the module of magnetic induction in an electromagnet gap.

CONCLUSIONS

The method of optimum design of electromagnets of magnetic levitation on the basis of the solution of conditionally correct inverse problems with use of two target functions received on the basis of restriction for magnetic induction in an electromagnet gap on tongue attraction force is offered. Minimization is carried out by method of gradient descent. At the same time magnetic potential difference of the magnetizing coil and the geometrical sizes of a pole of an electromagnet are defined. Minimization of the third target function (mass of an electromagnet) carried out analytically with use of necessary and sufficient conditions allowed to receive formulas for calculation of its optimum sizes. Iterative algorithms of the inverse problems solution of magnetic fields are constructed. The offered method allows reducing considerably time of design of electromagnets in comparison with the known methods, for example, by penalty function method. It is practical to use the offered method and the realizing computer program as a part of the computer-aided engineering system of levitation transport systems.

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