

SOLVING THE PROBLEM OF OPTIMIZING PISTON CAM SLID BEARING OF TRACTOR ENGINE

O.G. Zaviyalov

Federal state budget institution of higher professional education “Chelyabinsk state agro-engineering academy”, Chelyabinsk, Russia (454080, Chelyabinsk, 75 Lenina square); federal state budget institution of higher professional education “Chelyabinsk state university”, Chelyabinsk, Russia (454000, Chelyabinsk, 129 Br. Kashirnyksh st.); e-mail: zavyalovog@mail.ru

The article provides an algorithm, a program, and results of calculations that are based upon an approximate mathematic model of dynamically-loaded piston cam bearings considering the method of calculating statically-loaded slid bearings.

The approximate mathematic model describes a relation between initial parameters of piston cam bearings with exploitative and constructive factors. The model is based upon the method by M.V. Korovchinskogo on hydromechanics evaluation of statically-loaded slid bearings [1]. Approximation of the provided table data with relatively simple, but exact analytic expressions has been carried out during the creation of the model. Approximation has been carried out via a program, developed by the author in MATLAB environment. Input of the initial data and calculations output is carried out via a user-friendly interface.

Considering the set limitation and initial parameters, the program allows us to calculate an optimal size of the bearing.

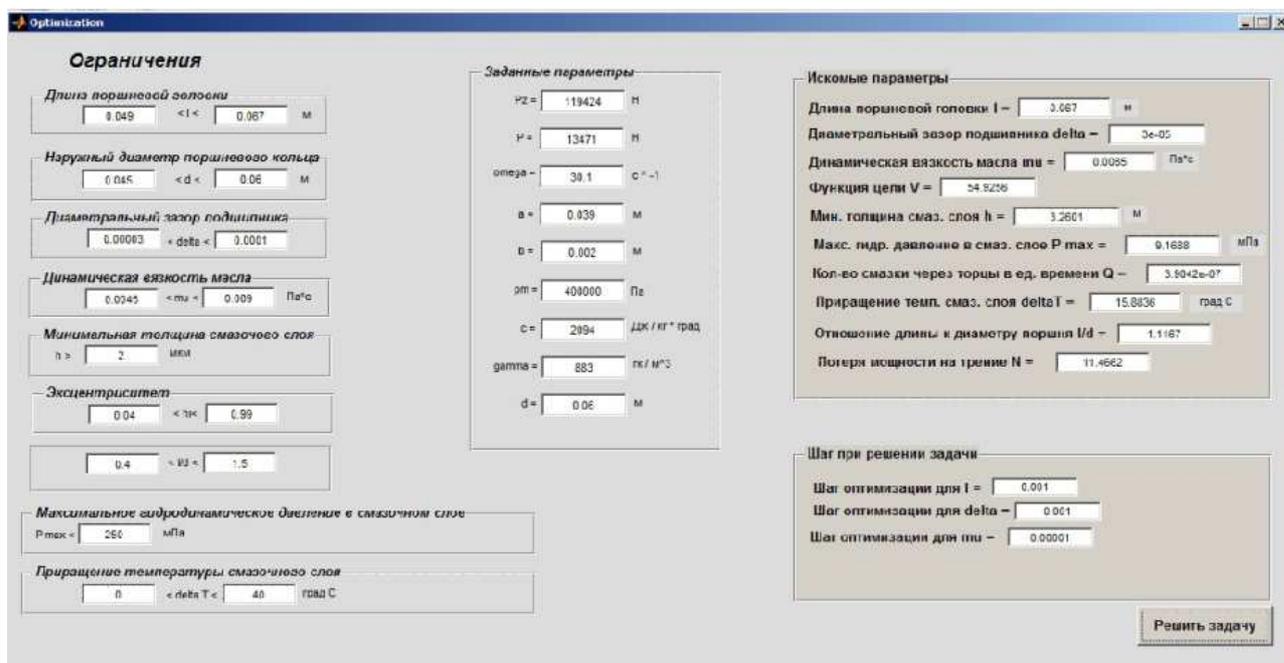
Values, defined through the approximation tables, depend on three parameters: angle extent of greasing layer or covering angle (120° , 180°), relative concentricity χ ($0,4 \div 0,99$), and relation between piston head length and piston diameter l/d ($0,4 \div 1,5$). The studied bearings work in terms of low angle spike speed and low oil viscosity.

Before the calculations we have to input the set (constant) parameters: grease supply pressure; specific oil heat capacity; specific ill mass; piston diameter. The following limitations are introduced: piston head length l ; diametral bearing gap Δ ; dynamic oil viscosity μ ; maximum hydrodynamic pressure P_{max} ; evaluation of dynamic bearing load in terms of semi-liquid and limiting friction P_z ; increase in greasing layer temperature ΔT ; 0 concentricity χ ; relations between piston head and piston diameter l/d .

Searched parameters are: l – piston head length; Δ - diametral bearing gap; μ - dynamic oil viscosity.

Optimization of bearing parameters is carried out via method of gradient descent [2]:

The program interface is provided in picture 1.



Picture 1.

The program allows us to calculate optimal bearing size with the set limitations and initial parameters.

Key words: optimization, method of gradient descent, piston cam bearing.

Bibliographic list:

1. M.V. Korovchinskiy Theoretic foundations of slid bearings. –Moscow, Mashgiz, 1959, 106 p.
2. V.I. Surkin, B.V. Kurchatov Greasing of tractor engines (monograph). –Chelyabinsk, 2009, 226 p.

DECISION OF OPTIMIZATION PROBLEM FOR TRACTOR PISTON FINGER BEARING

Zavyalov O.G.

Chelyabinsk state agricultural engineering academy, Chelyabinsk, Russia, (454080, Chelyabinsk, Lenin avenue, 75); Chelyabinsk state university, Chelyabinsk, Russia, (454080, Chelyabinsk, Br. Kashirinih St, 129),

e-mail: zavyalovog@mail.ru

Keywords: optimization, gradient release method, bearing of piston finger.

Decision problem tractor