APPLIED MECHANICS

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RESEARCH OF THE BENEFITS OF LEARNING PROGRAMMING LANGUAGES FOR MODERN MECHANICAL ENGINEERS

ДОСЛІДЖЕННЯ ПЕРЕВАГ ВИВЧЕННЯ МОВ ПРОГРАМУВАННЯ СУЧАСНИМИ ІНЖЕНЕРАМИ-МЕХАНІКАМИ

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Today is the time of global digitalization of science and production, when all stages of the product life cycle and document flow in engineering companies are computerized. As a result, companies need more and more employees trained in information and computer technologies, from the lowest to the highest level.

For example, managers, administrative and engineering staff of all departments must use CAD-, PDM-, PLM-, CALS-systems, sometimes CAD- and CAM-systems, office software as users. It is well known that the most effective user is the one who understands algorithmization and understands the nature of the software. So, the basics of algorithmization and practical programming experience at a basic level facilitate the interaction of the employee with the software, improve the quality of work, job satisfaction, quality of life.

For a mechanical engineer who designs a product or process, additional calculations are required. Calculations performed by mechanical engineers are often very simple, but large in the number of mathematical operations, contain many variables, correction factors, table values, which often have to be selected and recalculated. To facilitate these routine calculations, ready-made software can be used: spreadsheets [1, 2], computer algebra systems [2], etc. Taking into account the commercial nature and versatility of such software, it has certain disadvantages: the need to purchase software at a high price, the inability to use some mathematical operations, the fact that the loop operator is not always available, the need to manually enter tabular data and many specific formulas, the need to train staff both in the software itself and in the projects developed by the authors, the developed project may not open on another computer, etc.

Once open source programs are developed for certain narrow tasks with a user-friendly interface, an engineer's daily work can become more creative, more focused on solving the company's engineering problems, reducing the time spent on calculations. For example, [2-4] propose robotic computations in C#, C++, MathLab. Advantages of certain applications: friendly and usable interface that is intuitive for a professional mechanical engineer, even for someone using the application for the first time, free and functionally flexible if you use open source applications, the application runs fast even on a weak computer. However, there is a small drawback: engineers need to know the programming language.

In this work, in order to determine the minimum effective programming knowledge of a mechanical engineer, software was developed to compute a typical task for a mechanical engineer. It analyses the operators and operands required, assesses the complexity of the algorithms and determines the required level of programming skills. A study of this issue in contemporary scientific articles and a search for resources with open source applications showed that this topic is topical and under-researched, with almost no such applications in the public domain.

In the Lazarus programming environment, using the Pascal programming language, we have developed an application (Fig. 1) that calculates the seating of the inner ring on the shaft and the outer ring in the housing for the bearings supporting the gearbox drive shaft, checks the seating spacing. During development, the full conditional statement if was often used, for example in strings:

if spos>0 then

showmessage('The selected bearing mount on the shaft meets the operational needs and the clearance is equal to: '+ floattostr(Spos) +'μm');

end else begin

showmessage('No clearance, select fit with lower tension inner ring – shaft'+floattostr(spos)+floattostr(deltaD));

end;

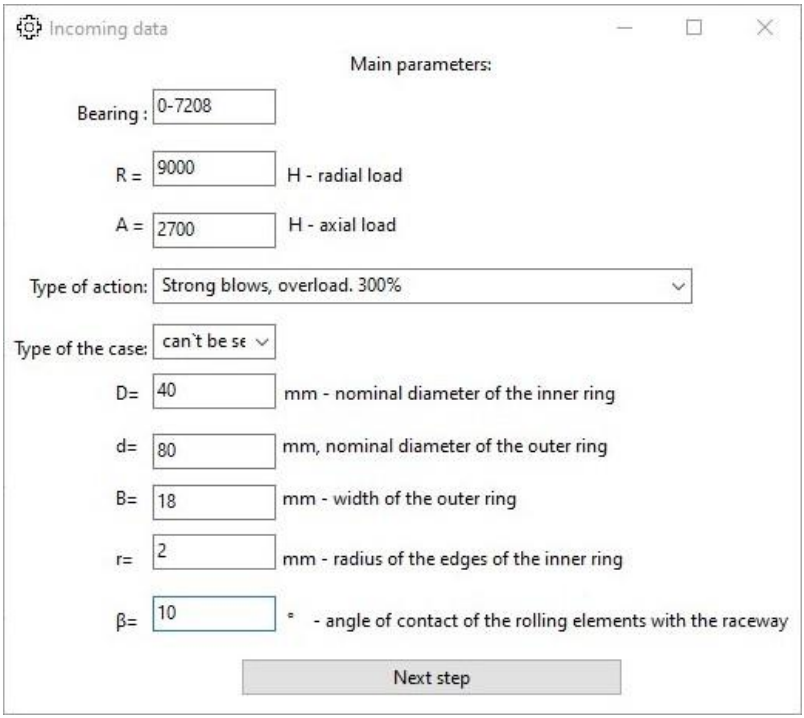

Fig. 1. Input data input window

The study of the conditional operator is included in the most basic school programming course and is usually well taught. It is the most appropriate of all operators.

In developing the application, several tables with standard tolerance intervals were created to quickly select a match using StringGrid. It is a bit more complex to work with than the primitive components Label, Button, Edit, but it is very efficient for working with tabular data.

In summary: simple conditional operator commands, form components Label, Button, Edit, StringGrid, simple arithmetic operands were used (Fig. 2). In general, the design and calculations are not complicated from the point of view of algorithmization and programming, only the interface design is time-consuming. So even a school course, slightly reinforced by a university course, is enough to be able to program. And the possibilities of the Pascal language and the Lazarus development environment are quite functional.

The benefits of learning programming languages for mechanical engineers: development of cognitive abilities, logical thinking, understanding of how software works, ability to write code to facilitate the typical repetitive calculations of routines.

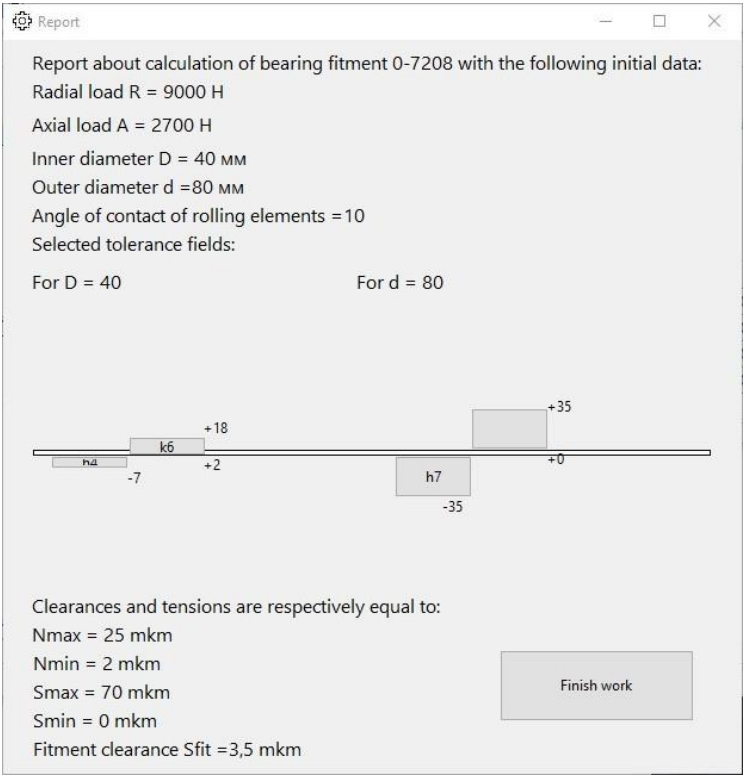

Fig. 2. Calculation results window

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TO CALCULATE THE DRIVES OF SCREW COMBINED CONVEYORS FOR TRANSPORTING WASTE FROM MECHANICAL INDUSTRIES AND AGRICULTURAL INDUSTRY

ДО РОЗРАХУНКУ ПРИВОДІВ ШНЕКОВИХ КОМБІНОВАНИХ КОНВЕЄРІВ ДЛЯ ТРАНСПОРТУВАННЯ ВІДХОДІВ МЕХАНІЧНИХ ВИРОБНИЦТВ ТА АГРАРНОЇ ПРОМИСЛОВОСТІ

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