

## SYSTEM OF SHAFT CALCULATION AND 3D MODELING

Igor Gorobets, Olexander Chubuchnyi, Oleksii Gorobets

Donetsk National Technical University, Ukraine

Corresponding author: Igor Gorobets, [gorobec@mech.dgtu.donetsk.ua](mailto:gorobec@mech.dgtu.donetsk.ua)

**Abstract:** CALS-technologies usage is one of the indispensable conditions of a modern company success. Parts of CALS-technologies are CAD/CAM/CAE – systems. The authors have developed the system of parameters shaft calculations, as a part of PLM-systems of CALS-technologies. The system calculates responses in the supports, fulfils the graph construction of the moments and shaft rotation angles. The system allows to carry out a choice of bearing knots and surfaces for twisting moment transmission. For the 3D-model detail construction it is necessary to set the material, shaft working conditions. The 3D-models construction is carried out by means of CAD systems KOMPAS-3D.

**Key words:** calculation, parameters, shaft, element, moment, force

Distinguishing feature of Engineer Shaft is integration of shaft calculation and selection of bearings, that allows to facilitate and accelerate process of machinery and mechanisms components designing.

**Results of program work are:**

- Supporting forces

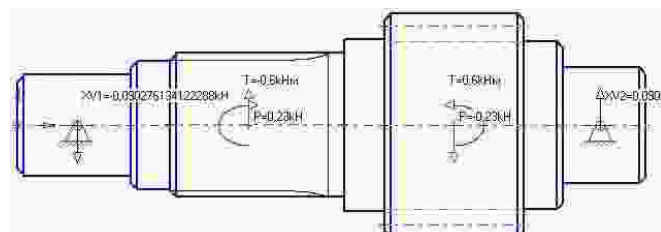


Fig. 1. Results of shaft supporting forces calculation

- Diagrams of the bending moments in a vertical, horizontal plane and total diagram



Fig. 2. Diagrams the bending moments

Constructed diagrams allow to define parameter point on shaft length with discontinuity 3mm.

- Diagrams of the shaft defected axis in a vertical plane, a horizontal plane and total diagram.

### 1. INTRODUCTION

Now in the world there is a diversity of business strategy that allow to effectively use resources of the company and to build enterprise business processes thus, that a production chain was flexible and had transparent and exact structure. One of the technologies, that is recognizable all over the world – the CALS-technology that has arisen in the middle of 80-years in the Department of Defense in USA. The important part of CALS-technologies is the PLM-system (*Product Lifecycle Management*). Company CIMdata PLM is a strategic approach to business that use a set of the coordinated business solutions supporting joint creation, management, distribution and use of the information, that describe a product from elaboration till recycling within the limits of the enterprise. One of PLM-system parts are CAE (*Computer Aided Engineering*). On section «Mechatronic» TU Donetsk has been developed program Engineer Shaft for shaft calculation an every possible structure by the setting geometrical shaft parameters, shaft material, heat treatment, and service conditions. This program allow to make geometrical calculations of some shaft elements, realize a choice of bearings. The system contains databases of the basic standard shaft elements, such as bushing key- and spline slots, bearings.

### 2. CALCULATION OF SHAFT

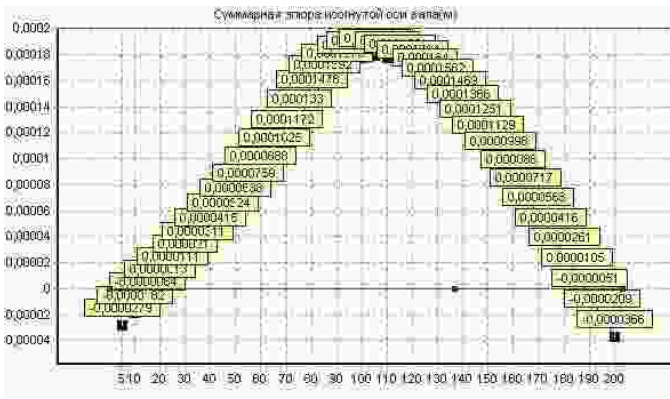


Fig. 3. Diagrams of the shaft deflected axis

- Diagrams of the shaft axis rotation angle corners in a vertical plane, a horizontal plane and total diagram.

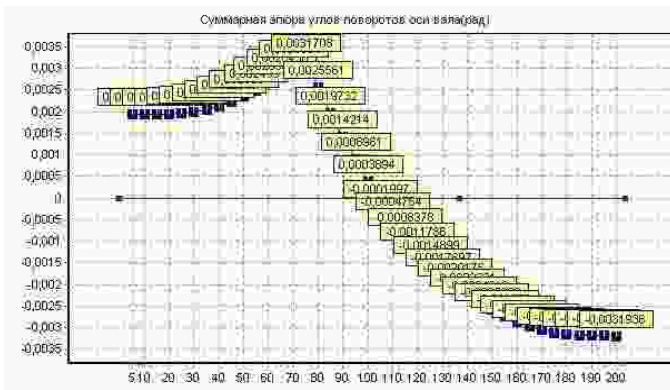


Fig. 4. Diagrams of the shaft axis rotation angle corners

- Twisting moment diagram

User can save program simulation data in image formats (bmp, JPG etc.) and in the text document. At project saving in a format ' chf ' user can open the project and edit in future.

- Choice of bearings from a database
- Generation 3D models in the program COMPAS 3D.

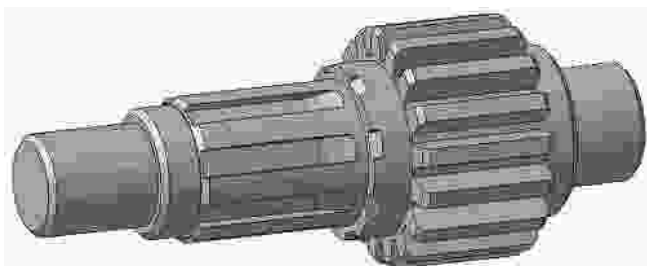


Fig. 5. Generated 3D model

The program facilitates a choice of the standardized shaft elements – bushing keys and spline slots, that geometrical parameters are saved in a program database.

For gear shaft construction it is necessary to set a kind of toothing, the module and number of teeth of a wheel and a gear wheel.

- User can choose the shaft material from a program database.
- Values and directions of the radial and axial forces, that operating on a shaft, value of the transferred twisting moment on a shaft.
- Coefficients of working conditions, the working temperature, necessary durability of bearings etc.



Fig. 6. Window of input of input data for gear shaft construction.

### 3. CONCLUSIONS

The developed module of shaft calculation allows to integrate the CAD system COMPAS with system of the dynamic condition of details analysis. The developed module is used in educational process of Donetsk technical university by special disciplines studying at specialisation «Mechatronic». The module can be useful to engineers of the industrial enterprises at calculations of transmission of projected devices carrying.