ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 5, Issue 5 , May 2018

Development of designs and methods for calculating gears with variable parameters and elastic elements

DJURAYEV ANVAR DJURAYEVICH, BEKNAZAROV JASUR KHOLMAMATOVICH

Doctor of science, Professor, Tashkent Institute of Textile and Light Industry
Senior researcher of Academy of science, Uzbekistan, Navoiy branch

ABSTRACT: At the present stage of the development of machine and instrument engineering, when implementing tasks, the industry of the country - to increase the efficiency of using new scientific achievements, to introduce more and more sophisticated small and light machine and instrument designs - paramount importance is given to the quality of transmission mechanisms with high transmission ratios. To the types of mechanical transmissions, the use of which will allow solving the problems of designing machines and devices in a new way, is a wave gear transmission based on the principle of transferring rotational motion due to the continuous deformation of one of the gear wheels.

KEYWORDS: circular stiffnesses, gear, Rubber bushings, transmission shafts, general transmission, gear wheel, driving gear

I.INTRODUCTION

The invention relates to mechanical engineering and can be used in the drives of technological machines operating with displaced loads. In a known design, the gear train comprises drive and driven gears, the teeth of which transmit the rotational movement from the shaft of the driving gear to the driven gear [1].

The disadvantage of this transmission is the lack of absorption of peak values of load (torque) oscillations on transmission shafts when using transmission in the drives of technological machines operating with variable loads. This leads to a rapid wear of the teeth of the wheels, high noise, the failure of bearing bearings, thereby reducing the life of the gear, especially at high speeds.

In another gear design for obtaining an alternating gear ratio, the gears are mounted eccentrically on the shafts [2]. The disadvantage of this design is not a high transmission life due to increased wear of the teeth, as well as imbalance of the wheels leading to vibrations and breakdown of the transmission elements.

In the following construction, the gear train comprises driving and driven wheels, the tooth profiles of which are made circularly convex on one and concave on the other wheel. In this case, the height of the protrusions of the circular teeth of one of the wheels, the depth of the troughs of the circular teeth of the other wheel, the radii and the steps of the circular teeth are different for different pairs of corresponding protrusions and valleys.

The disadvantage of the known transmission is the complexity of the design, low transmission life, and the lack of absorption of peak loads on the transmission shafts.

For the prototype, transmission is accepted according to [1]. The aim of the invention is to reduce the peak values of the load oscillations on the transmission shafts, increase the service life, and reduce noise, especially at high speed operation modes. The task is achieved by improving the design of the gears, including elastic elements.

ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 5, Issue 5 , May 2018

II. SIGNIFICANCE OF THE SYSTEM

The essence of the recommended gear transmission is that the gears are made in a composite, including a hub rigidly mounted on the shaft, a rim with teeth, between which there are elastic elements in the form of rubber bushes, the gear wheel and pinion having two rubber bushings, inner and outer different circular stiffnesses made of different brands of rubbers. At the same time, the circular stiffness and the rubber stamp of the inner rubber bush of the gear are selected with the same circular stiffness and the rubber stamp of the outer rubber bush of the gear wheel and the corresponding circular stiffness (rubber stamp) of the outer rubber bushing of the gear wheel is also chosen to have the same circular stiffness (rubber stamp) of the inner rubber bushing of the gear, In this case, the circular stiffness of the outer rubber bush is greater than the circular stiffness of the inner rubber bushing of the gear. Rubber bushings between themselves and the hubs and rims of gears and wheels are rigidly connected.

The proposed gear transmission provides a reduction in tooth wear and noise due to the damping of the rubber bushes of the gear and the gear wheel.

The gearing is explained in the drawing, which shows the general transmission scheme.

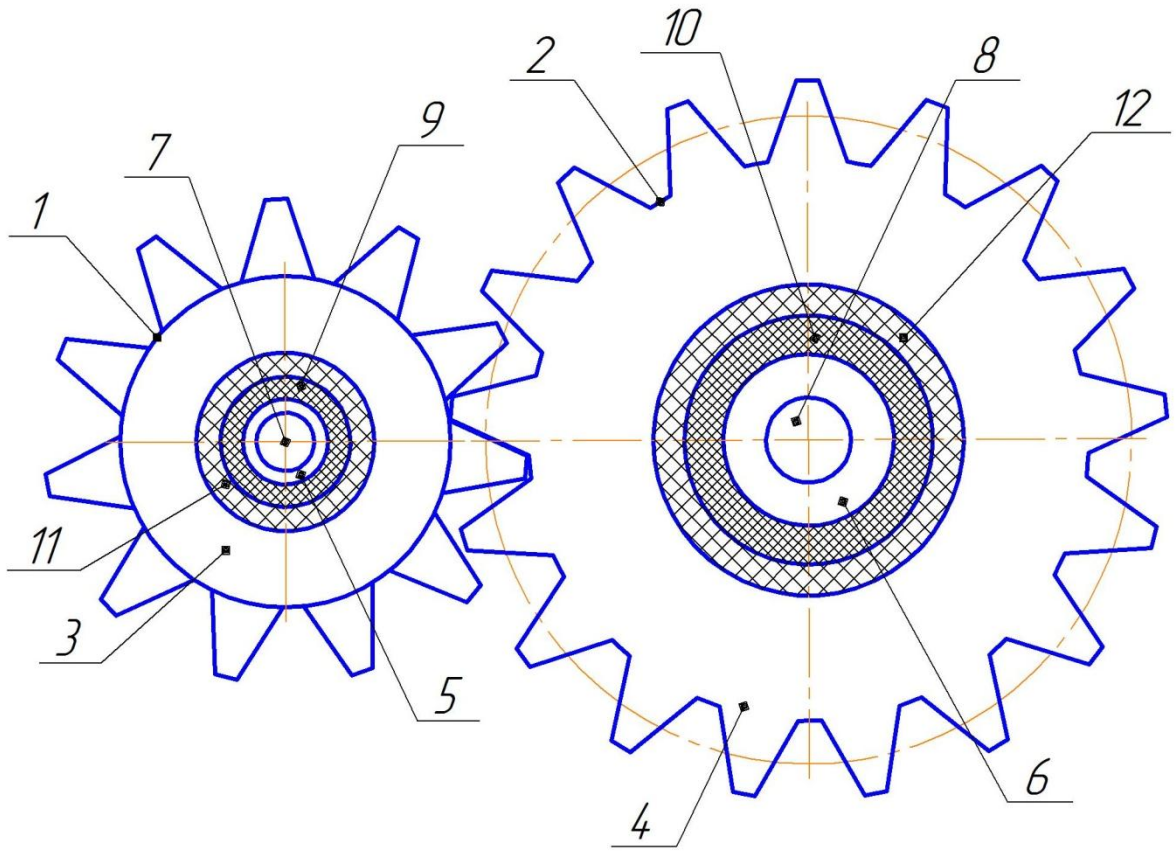


Fig. 1.

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 5, Issue 5 , May 2018

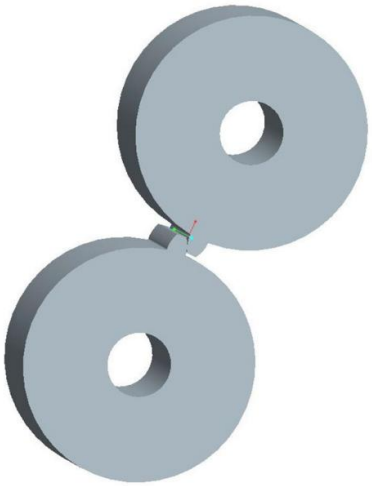
III. METHODOLOGY

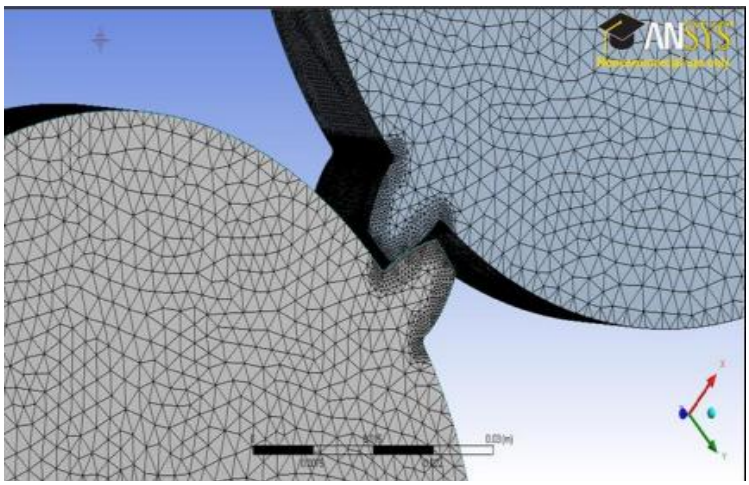
The gear train comprises a composite driving 1, driven 2 gears that include rims 3 and 4 with teeth, hubs 5 and 6 rigidly mounted on shafts 7 and 8. Between the rims 3, 4 and hubs 5 and 6, elastic (rubber) sleeves 9, 11 and 10, 12.

The gear wheel 2 and the pinion 1 each have two rubber bushings internal 9, 10 and outer 11 and 12. The circular stiffness C1 of the rubber bushings 9 and 12 are the same and are made from the same rubber type, and also the tensional stiffness C2 of the rubber bushings (rubber brand) 10 and 11 are chosen to be the same, while C2> C1.

The gear train works as follows. The rim 3 with the teeth of the driving gear 1 receives rotational motion from the drive motor (not shown), the shaft 7, the hub 5 through the elastic sleeves 9 and 11. When the teeth of the wheels 1 and 2 engage, the rotational movement is transmitted to the rim 4 with the teeth and through the elastic sleeves 12 and 10 the hub 6 and to the shaft 8. Under the influence of external loads and technological resistances, the torque on the shaft 8 changes. The peak values of the moment oscillations are absorbed by the elastic sleeves 10 and 12. Further, the peak values of the loads are also absorbed into the control In the case of the bushings 9 and 11 of the driving gear 1 (pinion). In this case, the torques on the shafts 7 and 8 will be somewhat smoothed to some extent.

When transmitting the moments between the pinion 1 and the gear wheel 2, the rubber bushings 9 and 12 will be less circularly deformed, since their circular stiffness's are chosen to be greater than the circular stiffness's of the rubber bushings 10 and 11.





In this case, the rubber sleeves 10 and 11 will deform more due to C2> C1. This provides a wide range of absorption frequency of the oscillations of the transmitted moments between the pinion 1 and the gear 2
The gear transmission ensures a reduction in the peak values of the oscillations of the loads on the transmission shafts, an increase in the service life, and also reduces noise, especially at high speeds and a wide range of changes in process loads.

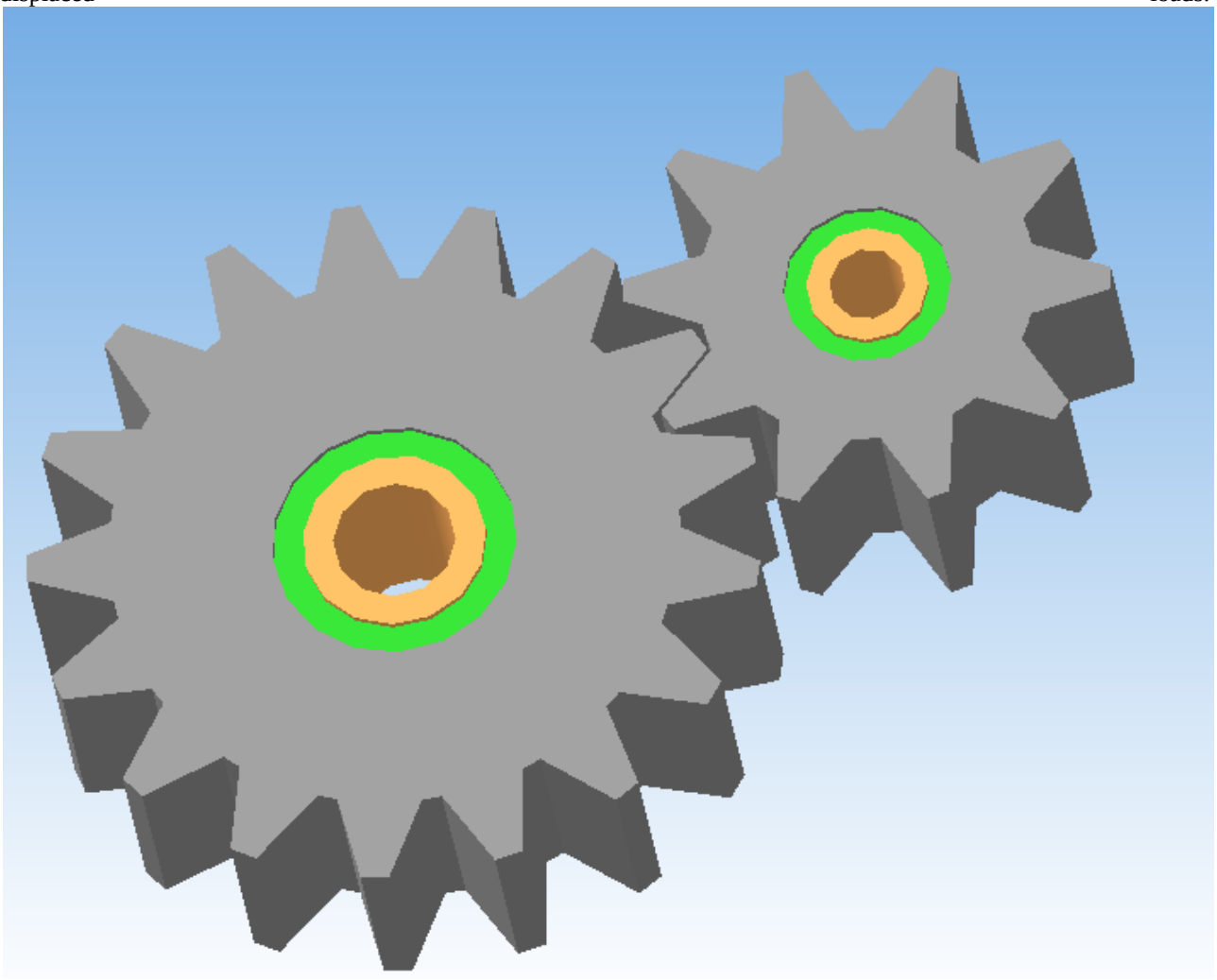
IV. EXPERIMENTAL RESULTS

The gear train comprising a driving and driven gears mounted on the shafts, characterized in that the gear wheels are made integral, comprising a hub rigidly mounted to the shaft, a rim with teeth, between which are mounted resilient elements in the form of rubber bushes, the gear wheel and pinion having two rubber bushings, inner and outer with different circular rigidity made of different brands of rubber, while the circular stiffness and the rubber brand of the inner rubber bushing of the gear are the same the rubber stiffness of the outer rubber bushing of the gear wheel and the corresponding circular stiffness (rubber stamp) of the outer rubber bushing of the gear wheel is also selected to have the

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 5, Issue 5 , May 2018

same circular stiffness (rubber mark) of the inner rubber bush of the gear wheel, the circular stiffness of the outer rubber bush greater than the circular stiffness of the inner rubber the bushings of the gear, the rubber bushings between each other and the hubs and rims of the gear and the wheels are rigidly connected.

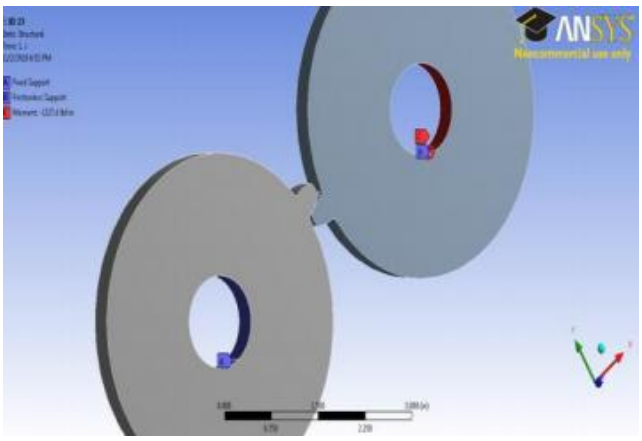
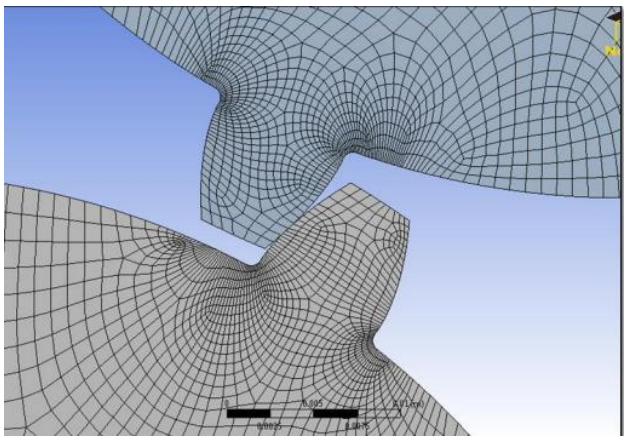
The invention relates to mechanical engineering and can be used in the drives of technological machines operating with displaced loads.



The aim of the invention is to reduce the peak values of the load oscillations on the transmission shafts, increase the service life, and reduce noise, especially at high speed operation modes.

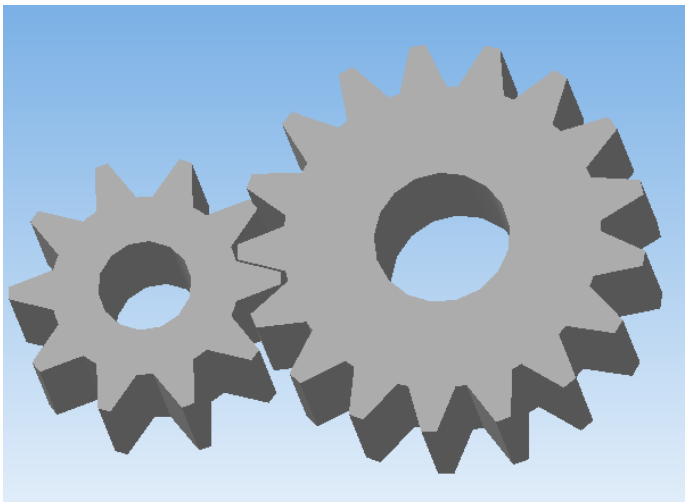
The task is achieved by improving the design of the gears, including elastic elements.

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 5, Issue 5 , May 2018

V. LITERATURE SURVEY

The essence of the recommended gear transmission is that the gears are made in a composite, including a hub rigidly mounted on the shaft, a rim with teeth, between which there are elastic elements in the form of rubber bushes, the gear wheel and pinion having two rubber bushings, inner and outer different circular stiffnesses made of different brands of rubbers. At the same time, the circular stiffness and the rubber stamp of the inner rubber bush of the gear are selected with the same circular stiffness and the rubber stamp of the outer rubber bush of the gear wheel and the corresponding circular stiffness (rubber stamp) of the outer rubber bushing of the gear wheel is also chosen to have the same circular stiffness (rubber stamp) of the inner rubber bushing of the gear, In this case, the circular stiffness of the outer rubber bush is greater than the circular stiffness of the inner rubber bushing of the gear.



VI. CONCLUSION AND FUTURE WORK

Rubber bushings between themselves and the hubs and rims of gears and wheels are rigidly connected. The proposed gear transmission provides a reduction in tooth wear and noise due to the damping of the rubber bushes of the gear and the gear wheel.

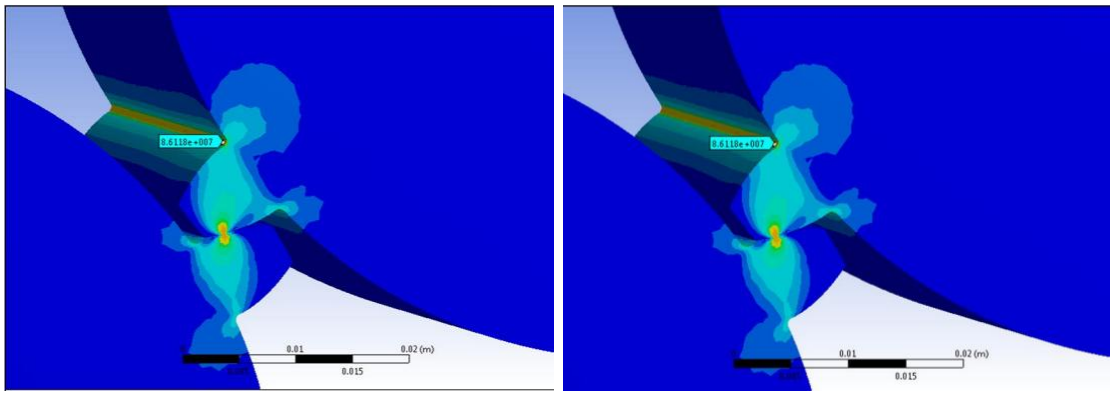
Gears analyses in the past were performed using analytical methods, which required a number of assumptions and simplifications. In general, gear analyses are multidisciplinary, including calculations related to the tooth stresses and to tribological failures such as like wear or scoring. In this thesis, static contact and bending stress analyses were performed, while trying to design spur gears to resist bending failure and pitting of the teeth, as both affect transmission error. As computers have become more and more powerful, people have tended to use numerical approaches to develop

ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 5, Issue 5 , May 2018

theoretical models to predict the effect of whatever are studied. This has improved gear analyses and computer simulations. Numerical methods can potentially provide more accurate solutions since they normally require much less restrictive assumptions. The model and the solution methods, however, must be chosen carefully to ensure that the results are accurate and that the computational time is reasonable. The finite element method is very often used to analyze the stress state of an elastic body with complicated geometry, such as a gear. There have been numerous research studies in the area.



REFERENCES

[1] Artobolevsky Theory of Mechanisms and Machines. Ed. "Science", Moscow: 1988, 639 p.
[2] Toothed gear. Author's certificate No. 514047, bul. № 8, 1976.
[3] Toothed gear. Author's certificate № 1551889, bul. № 11, 1990.