A Software System for Researching of the Traction Capability of Belt Transmissions with Flexible Bandage

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Abstract: *The software system realizes a traction calculation of belt transmissions and presents the results in an analytical and graphical way. The change of the input data occurs in a real time. The user can observe input data's influence over traction capability. Results have been discussed. Conclusions are made.*
Key words: *Belt Transmission, Flexible Bandage, Traction Calculation, Software System.*

INTRODUCTION

In [3] a theoretical investigation for the traction capability of belt transmission with flat belts and steel work-surfaces of the belt pulleys is presented. The following equation has been derived:

$$\beta_1 = \frac{1}{\mu}\ln\frac{1+\varphi}{1-\varphi} \qquad (1)$$

In this eqation the following parameters are used:

β_1 is the angle of the elastic slippage by steel work-surface of the belt pulleys,

μ is the friction coefficient between the belt and the belt pulley,

φ is the traction coefficient.

Aiming to increase the traction capability of the belt pulley bandages from elastic material can be assembled [4]. Setting bandages to the pulleys is also the most often applied variant by caterpillar drive systems [2, 5, 6]. This circumstance imposes the development of a theoretical module for determining the traction capability that takes into consideration the ratio of the hardness of the work surfaces of the belt pulleys and the belt. Such an investigation is presented in [4]. The following relation is derived:

$$\beta = \frac{1}{\mu}\ln\left(2k\frac{\varphi}{(1-\varphi)(1+C)}+1\right) \qquad (2)$$

In the second equation the following parameters are used:

$C = \frac{C_p}{C_б}$ is the ratio of the hardness of the work surfaces,

C_p is the hardness of the work surface of the belt,

$C_б$ is the hardness of the work surface of the pulleys.

The hardness coefficients C_P и $C_б$ are generalized because they take into account the deformations from contraction and tension, which cause displacements in the contact area.

The coefficient k is considering that part of the force F_T , which is transmitted in the area of the elastic slippage as a result of the displacement of the crosssection of the belt [1]. It depends mainly from the thickness of the belt. According to the experimental research in [1], by belt thickness 10 mm - $k = 0.9$ and with the increasing of the belt thickness with 10 mm the coefficient will be reduced each time with 0.1.

In the developed up to this moment teaching resources at the Department of Machine science and Machine elements there is not a software system for the research of the traction capability of belt transmitions with flexible bandage. The creation of a software product which will enable the stidents to study the improvement of the traction capability of the belt pulleys through usage of bandages would be quite usefull.

An analysis and selection of the kind of the program system (application, macros, ActiveX, etc) should be carried out as well.

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The above-formulated problem was solved creating a software system for researching of the traction capability of belt transmissions with flexible bandage. The flowchart for the functioning of the software system is presented on the Fig.1.

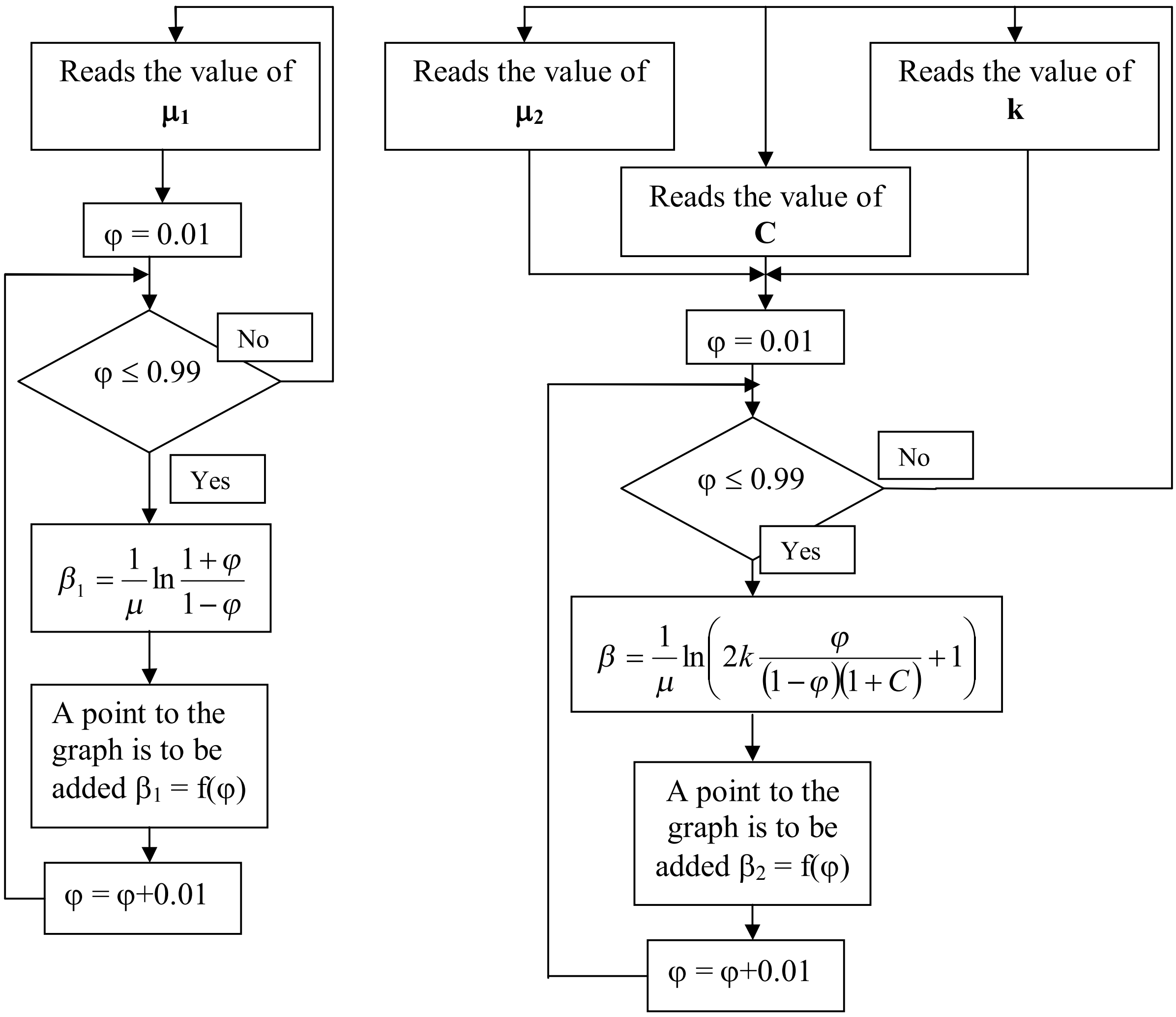

Fig. 1. Flowchart of the developed software system

Three applications have been developed – one for working directly under Windows (BT.exe), another one - for working in the environment of LabView (BT.vi) and the third one – for building in applications, macroprograms and websites (BTActiveXControl.OCX).

BT.exe is small in size (600K), it does not require access to the system register and does not need the availability of a certain application (e.g. LabView). The main window of BT.exe is presented in Fig.2.

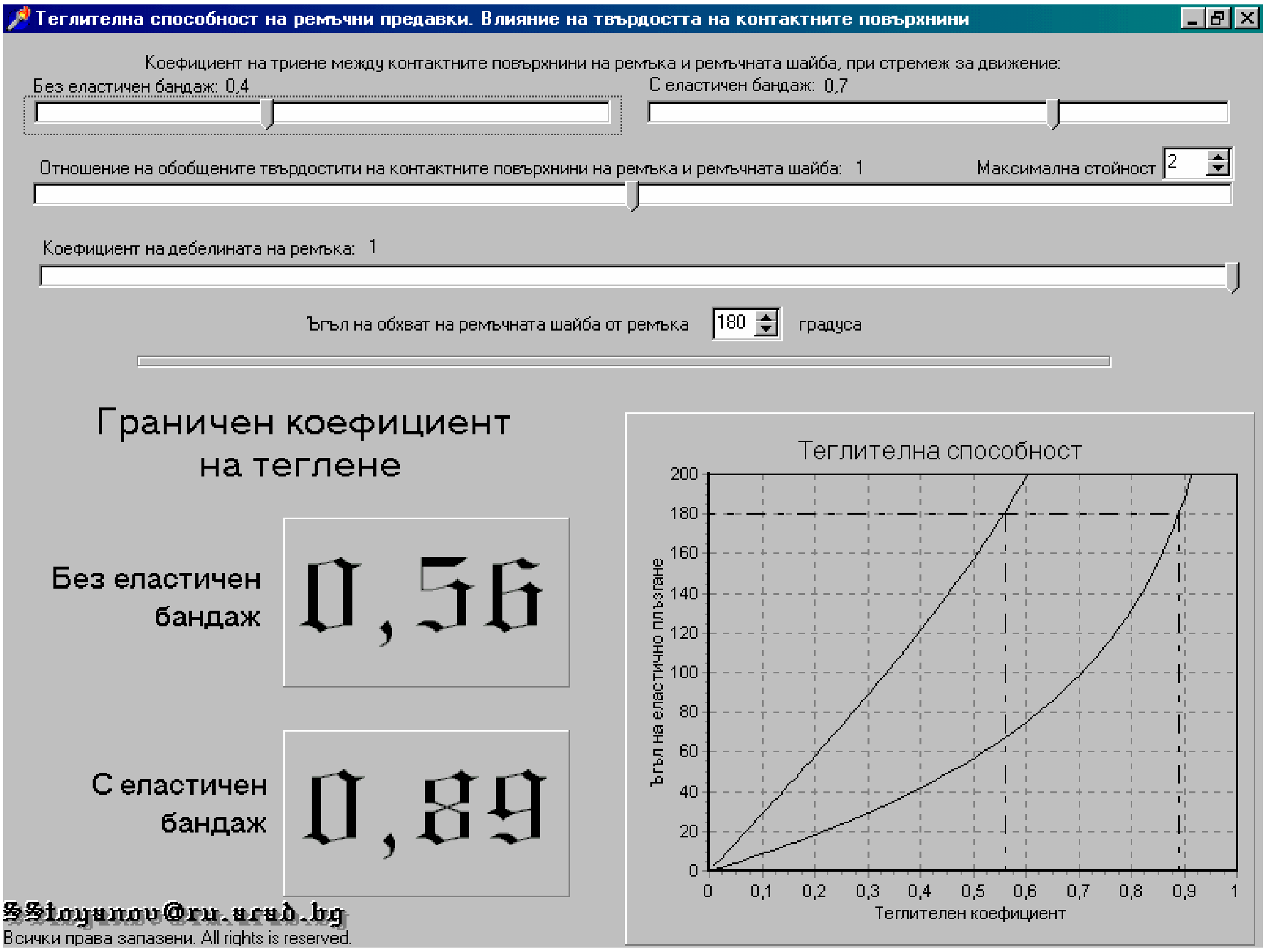

Fig. 2. Main window of BT.exe

In order the user to work with BT.vi, LabView (a version not lower than 5) should be installed. The building in and the interactive work of vi-file in a webside are possible with the means of LabView RunTime Engine of National Instruments [7]. The diagram of BT.vi is shown on Fig. 3 and a window of the user interface – on Fig.4.

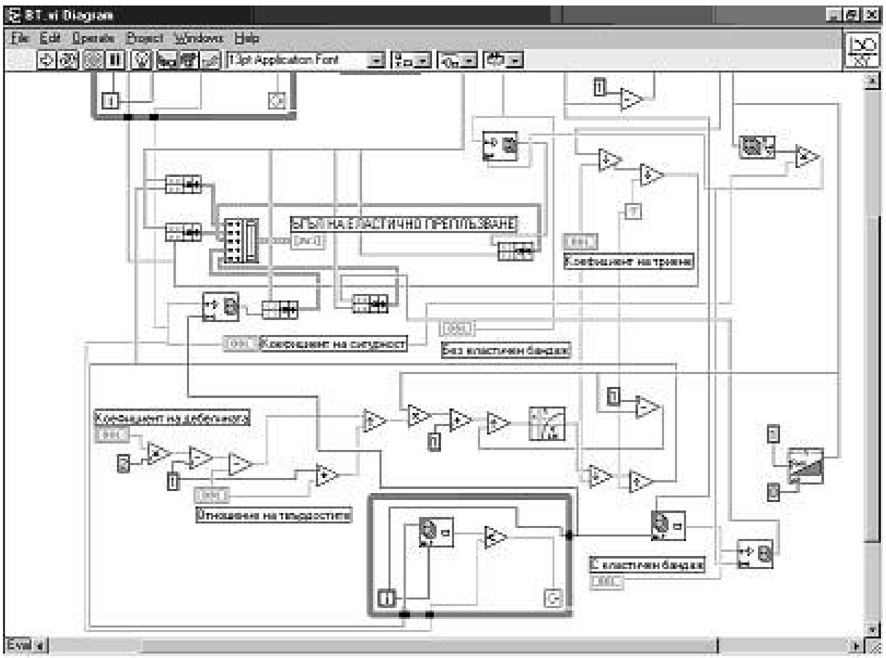

Fig 3. The diagram of BT.vi

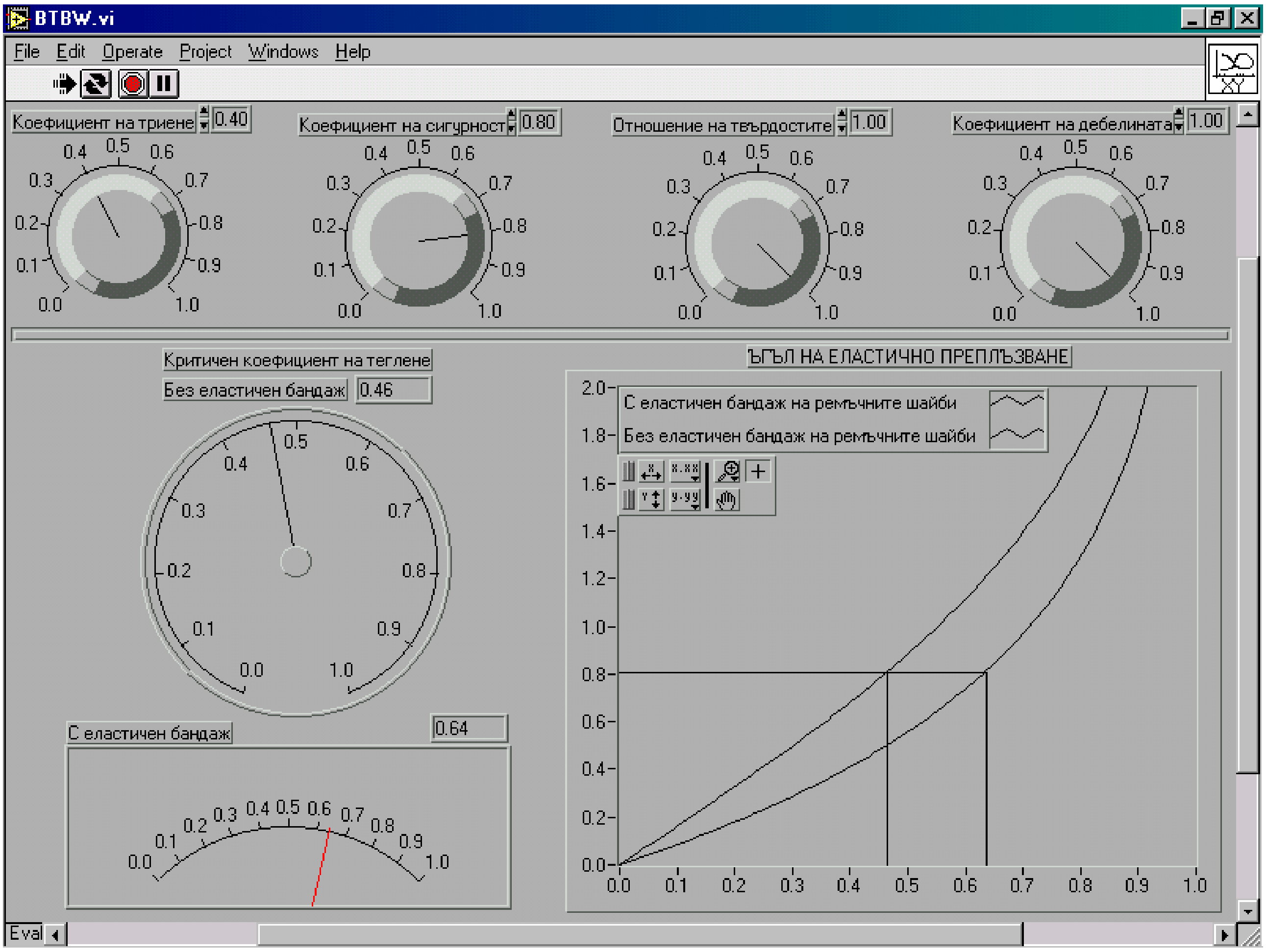

Fig.4. Window from the system BT.vi

BTActiveXControl has been elaborated with the help of the development system Delphi. The developed ActiveX Control has properties, which can be used to the set values of its input parameters.

CONCLUSIONS

1. A software system for researching of the traction capability of belt transmissions with flat belts and flexible bandages has been elaborated. The software system gives a quantity vision of the traction capability increase. It draws and overlaps the graphs of the traction capability of a belt transmission without a flexible bandage and a transmission with a flexible bandage.

2. Three applications have been developed – one for working directly under Windows (BT.exe), another one - for working in the environment of LabView (BT.vi) and the third one – for building in applications, macroprograms and websites (BTActiveXControl.OCX).

3. The elaborated software system has been introduced in the teaching process. It is a part of a tutorial book for the subject “Fundamentals of Machine Design” and we will build it in an e-Learning Shell.

REFERENCES

[1] Andreev A. Friction Transmissions. Maschinostroene, Moskva, 1978. (in Russian)

[2] Challenger – Firm catalogue of CLAAS.

[3] Stojanov S., A. Dobreva. Theoretical investigation of traction characteristic of belt transmissions. – Proceedings of international conference “POWER TRANSMISSIONS'03”, Varna, Bulgaria, September 11-12, 2003, p. 104-107.

[4] Stoyanov S. Theoretical investigation of the traction capability of a belt transmission as a function from the Hardness of the Work Surfaces of the Belt Pulley and the Belt. – Proceedings of IV INTERNATIONAL CONGRESS "MECHANICAL ENGINEERING TECHNOLOGIES`04", Varna, Bulgaria, 23. – 25. September, 2004, (to be published).

[5] http://www.caterpillar.com

[6] http://www.claas.com

[7] http://www.ni.com

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