

Program System for Study of Surfaces' Micro Geometry

Vassil St. Donev¹, Slava M. Jordanova²

Abstract – The paper presents program environment for study of surfaces' micro geometry. Proposed solution allows for substantial increase of monitored roughness parameters as well as for some new studies related to the functional features of the surfaces.

Keywords – roughness, surface, parameter of surface

I. INTRODUCTION

The limited number of parameters defining roughness, submitted in the standards with numerical value, is related with the insufficiency of research of different parameters of roughness influence over the operational features of surfaces. The progress of microprocessor technique and the introduction of personal computers to the control – measuring technique allow wide ranges of possibilities for the devices, and more parameters to be monitored. [1,2,3,4]

The aim of this research is the creation of a program system for study of micro geometry of surfaces to provide determination of vastly larger number of parameters of roughness, and to allow studies related with the operational features of surfaces. The calculations are made on the base of data taken from system consisting of profile meter and analogue – digital converter ADC363. Parameters definition is based on going standards ISO 4287/1 and ISO 4287/2.

II. SYSTEM FOR TAKING THE INPUT DATA

The system for taking the input data is built on the base of the profile meter TAYLORHOBSON/Surtronic 3 (Great Britain).

Technical data:

Range of measurement - 0-9.99 and 0-25 μm Ra;

Value of the piece - 0.25;0.8;2.5;8; 25 mm;

Feeler speed - 1mm/s per Ra; 0.25mm/s for a record;

Reading – Digital display;

Output - 10 mV/ μm for range 99.9, 100 mV/ μm for range 9.99;

Measuring precision - $\pm 2\%$ of the reading;

Environmental features :

temperature - $+5 \div +40^\circ\text{C}$;

humidity - $0 \div 99\%$ relative humidity;

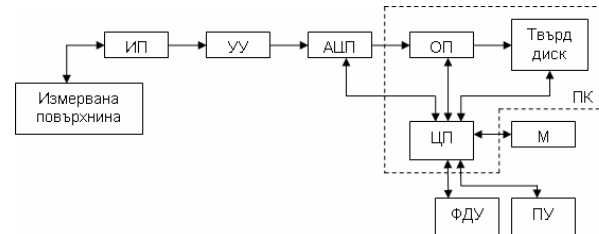


Fig. 1. Main blocks of the system

Symbols:

ИП – measuring device;

УУ – amplifier;

АЦП – analogue – digital converter;

ОП – random access memory;

ПК – personal computer;

М – monitor;

ЦП – central processing unit;

ФДУ – floppy disk drive;

ПУ – printing device;

The studied surface is tried by the feeler of the measuring device. After processing in the amplifier the obtained electrical analogue signal goes direct to the input of the analogue – digital converter. The analogue – digital converter transforms the information into digital and loads it into the random access memory of the personal computer. Right after that, the data is saved as a file on the hard disk drive of the personal computer. [1,2,3,4]

The developed program system reads the so created file and processes the information received. The calculated results for the parameters of the roughness are visualized on the monitor of the personal computer. The results might be printed on paper if needed or saved as a file on the hard disk drive or on a floppy diskette.

The program system processes the input data from measurements made with the system for obtaining input data. There are 25 parameters for roughness of the surface calculated for each base length as well as average for the five of them. The length of the base lengths is determined by ISO 4288 – 1985. The parameters of surfaces' roughness are determined by the standards of ISO 4287/1, ISO 4287/2.

III. SELECTION OF PROGRAM RESOURCES FOR PROGRAM REALIZATION

• Visual Basic .NET 2003

The environment for developing used in this work is Visual Studio .NET 2003 of Microsoft. It offers languages and tools for the creation of web – based, desktop and mobile applications.

¹ Vassil St. Donev - Technical University, 9010 Varna, Studentska str. 1, e-mail: donev@ms3.tu-varna.acad.bg

² Slava M. Jordanova - Technical University, Computer Sciences and Technologies, 9010 Varna, Studentska str. 1, e-mail: slava_y@abv.bg

The environment of .NET (.NET Framework) is a multi-lingual environment, providing a rich platform for programming, developing of web based applications, data control, control of the resources access, processing of XML, program interface to the protocols HTTP, DNS, TCP, UDP. The language used for the design and programming of this application is Visual Basic .NET. It is also designed over the .NET environment. [5,6,7]

- *InnoSetup*

InnoSetup is a free installer for Windows applications. It supports all versions of Windows: Windows 95, Windows 98, Windows 2000, Windows 2003, Windows XP, Windows Me, Windows NT, Windows 4.0. This application makes it possible to create a single installation file .EXE for easier distribution.

InnoSetup provides a standard Windows 2000/XP style of the interface, full Uninstall opportunities and options for shortcuts. Support of several compression algorithms. In the present work InnoSetup is used for creating of the installer of the application.

- *Macromedia RoboHelp*

Macromedia RoboHelp is an application for creating of Help systems and documents or desktop and web based applications. RoboHelp gives the programmer the opportunity to choose the editor to work with. RoboHelp HTML editor can be used as well as any other HTML editor (Dreamweaver, Frontpage, Microsoft Word etc.) for generating of any popular help format (FlashHelp, WebHelp, Microsoft HTML Help, WinHelp, JavaHelp, Oracle Help for Java, and XML), creating of HELP systems working on every platform and browser. In this work RoboHelp is used for the Help part of the application.[5,6,7]

- *Macromedia Captivate*

Macromedia Captivate is a product used for interactive simulations and software demonstrations in Macromedia Flash format. Here Captivate is used for building of the Video manual for the application. [7]

IV. PROGRAM

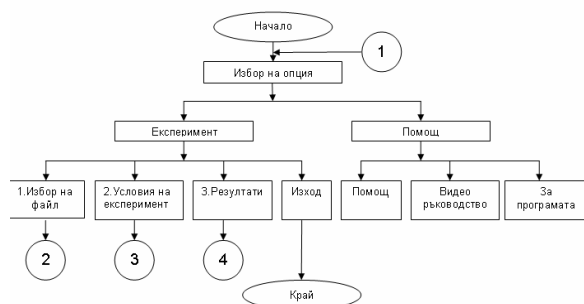


Fig. 2. Block scheme

The presented software system consists of:

frmMain.vb – main form;

ucPSelect.vb – control for tool selection;

ucResults.vb – control for visualization of the results;

mInit.vb – module containing functions loading data from the input file ;

mProcedures.vb – module containing procedures for mathematics realization.[5,6,7]

The main form *frmMain.vb* has operating functions. It watches the sequence of execution of the different stages of the experiment:

1. Selection of file;
2. Circumstances definition;
3. Results;

V. TESTING

Testing of the developed software system is made by external and structural tests, for finding and correcting of the errors.

- *External testing of program modules*

The external testing of modules is based on separating it from the main program and exploring its reactions resulted by the input data. [7]

- *Structural testing*

Structural tests are program oriented. For their realization are needed the following things:

- a) Software separating of the module and defining its informational relation to the system. If the module refers to other modules they also need to be tested or on their place are put imitators;
- b) Structure defining operators should be found and enumerated in the program source ;
- c) Depending of type and semantics of the operators they should be presented as conditional IF structures;
- d) Operators between two IF clauses are a linear section. IF operators are interpreted as nodes of the structural graph, and the linear sections as its arcs;
- e) The structure graph is separated to a sequence of linear and nested loop cyclic sections;

For the execution of this test is used Visual Studio NET debugger and its Watch module. Breakpoints are placed and the values that parameters take are monitored. The passing through the individual branches of the graph is monitored. [6]

For the testing of the software is selected the top down strategy, where the main module is tested first. During the tests is accented the realization of the following functions:

- Impossibility for passing to step 2 of the experiment, without file loaded. This is provided by inactive options of the main menu or by message boxes;
- Impossibility for passing to step 3 of the experiment, without being loaded a file and defined circumstances for the experiment. This is provided by inactive options of the main menu or by message boxes;
- Visualization of the controls for selection of the experiment circumstances and output of results.

System requirements for software installation:

For the correct work of the program must be covered the following software and hardware requirements:

Hardware:

- X86 or compatible processor;
- At least 64 MB of RAM memory;
- For installation is required 3.4 MB free disk space;
- Graphic card with at least 1 MB of memory;
- CD-ROM or Floppy disk drive.
- Minimal Software requirements:
- Windows 98, 2000, XP;
- NetFramework 1.1;
- Microsoft Internet Explorer 5.01;
- Microsoft Windows Installer 2.0.[5,6,7]

VI. CONCLUSION

1. The developed software system for measuring and studying of the roughness of surfaces affords:

- Automated defining of 25 parameters for estimation of the roughness for one base length or average for the five base lengths;
- Representing of the results of the measurement in digital and graphical format;
- Implementing of wide program for studying of the micro geometry of technical surfaces and disclosure of the bindings between the different parameters for roughness.

2. The developed software system provides user customizable measurement of the parameters of roughness. The system can be used as base for developing specialized programs for quantity estimation of the bindings between separate parameters of roughness.

3. The results of the experimental measurements in conditions similar to the practice, shows high precision and reliability of the system.

4. In economical plan the system saves using of devices produced by the famous firms like Perthen (Germany) and Taylor-Hobson (Great Britain), which are having similar метрологични indices with these of that system and smaller count measured parameters.

5. So obtained values of the parameters empower for calculation and determining of the trajectory of movement, instant and average speed, and acceleration of analyzed object.

6. The necessary amount of memory for storing data obtained during analysis is defined.

7. Through database values and appropriate software the complete object's behavior could be visualized during the process of analysis.

REFERENCES

- [1] Русева Е., Русев Р. – Физическо металознание, ВМЕИ – Варна, 1988 г.
- [2] Русева Е., Русев Р. – Физическо металознание – Ръководство за лабораторни упражнения, ВМЕИ – Варна, 1986 г.
- [3] „Програмиране на Microsoft Visual Basic .NET”, Джон Конел, Софтпрес, 2002 г.
- [4] Microsoft Visual Basic NET – Професионални Проекти, Премиерпрес, 2003 г.
- [5] Microsoft MSDN Library - <http://www.microsoft.com/msdn/>
- [6] VB-Helper - <http://vb-helper.com/>
- [7] Planet-Source-Code - <http://planet-source-code.com/>