

Łódź, dnia 18.05.2017 r.

Mgr inż. Norbert Kępczak
Doktorant V roku Studiów Doktoranckich
Budowa i Eksploatacja Maszyn
Wydział Mechaniczny Politechniki Łódzkiej
ul. Stefanowskiego 1/15, 90-924 Łódź

STRESZCZENIE ROZPRAWY DOKTORSKIEJ W JĘZYKU ANGIELSKIM

AN ABSTRACT OF A DOCTORAL DISSERTATION IN ENGLISH

A doctoral dissertation entitled "Research of selected operating properties of a machine tool body made of mineral material and cast iron" consists of 14 chapters. The thesis has been formulated that it is possible to improve the dynamic properties of the machine body by using mineral material and cast iron. In order to prove the thesis, the theoretical and experimental research of hybrid body of the machine tool made of connection of cast iron and mineral cast were described in this dissertation.

In the first chapter of the paper, an introduction to the topic of structural elements of the body type, their manufacturing technology, the vibration in the manufacturing processes and the effective methods of elimination of vibration sources was presented.

The second part is an analysis of the scientific literature about mineral casts used in the field of construction of machine tools and their mechanical and dynamic properties. In this chapter, a comprehensive description of the mineral cast material, comparison of mechanical and dynamic properties with respect to the traditional cast iron construction material were discussed. Previous attempts to use mineral castings as structural components of machine tools have also been reported.

The purpose, the thesis, the scope of work and the research plan were presented in the third and fourth chapter.

In order to create a virtual model of the mineral cast material, comparative study of the mechanical properties have been carried out what was described in chapter 5 of this dissertation. Based on the conducted studies, it can be stated that the data contained in the scientific literature of the mechanical properties of mineral casts has been confirmed. In addition, two more parameters have been determined that have not been found in the literature so far (Poisson's ratio and Kirchhoff's module of mineral casting material). The research of breakthroughs of the samples destroyed during the strength tests were also performed. In this part of the study, the analysis was performed to characterize microstructures and cracks in the mineral composite, as well as contact between resin and grains filler.

The sixth chapter describes theoretical modal analysis, which is one of three types of analysis of dynamic properties of mechanical objects. It applies when there is no way to perform tests on a real object. In addition, a methodology for performing theoretical modal analysis in the Autodesk Inventor program has been described.

Chapter 7 presents the numerical studies of the dynamic properties of the machine tool body. This chapter presents comparative, theoretical modal analysis for four constructionally similar lathe beds. The results of the analyses showed that the best results were obtained for the hybrid and cast iron designs which were selected for further consideration in the dissertation.

In order to confirm the results of the dynamic properties obtained in the previous chapter, the theoretical studies of the static properties of the indicated bodies were also performed, as described in Chapter 8. It is clear from the conducted studies in the case of the hybrid body that the deformation of the load was reduced with respect to the cast iron body.

Chapter 9 of this dissertation is a comprehensive description of the methodology of experimental modal analysis, as well as the instrumentation used to conduct the study.

Kępczak N.

In Chapter 10, experimental studies of the dynamic properties of machine tool bodies are presented. The method of conducting experimental research and the results were also discussed.

Comparison of theoretical and experimental results of dynamic properties of machine tool bodies is presented in Chapter eleven. As it is shown in the tables, graphs and drawings, despite the lower frequency of vibrations in some cases of hybrid construction, improvement of dynamic properties have been observed compared to the cast iron body. It can be determined by the decreasing value of the amplitude of the transition function H_1 and the increasing of damping ratio of the hybrid body in comparison to the cast iron body.

Chapter twelve presents an experimental study of the static properties of the machine tool body. Based on the experimentally obtained static test results, it can be concluded that the hybrid body is more rigid than the cast iron body because of the deformations from the loads are lower.

Chapter 13 presents a comparison of the theoretical and experimental results of the static properties studies of the lathe body. On the basis of the theoretical and experimental studies, it can be concluded that the entire hybrid structure has been stiffened by the filling free space with the material of the mineral cast.

The last chapter - the fourteenth - contains the summary and conclusions of the dissertation. Based on the theoretical and experimental studies, it can be clearly stated that the thesis has been proved and it is possible to improve the dynamic properties of the machine body by using mineral cast material and cast iron.

Керчек И.