

Abstract

Assembly accuracy of machine tool frame components

This work constitutes a continuation of studies conducted during project LIDER/07/76/L-3/11/NCBR/2012 System for selective assembly of machine tools, which research team author was a part of. The aim of this thesis is to develop a method for improving the accuracy of assembled machine tools by the analysis of machined surfaces of mechanical components. The work consists of 9 chapters. Chapter 1 contains the list of the most important symbols that occur in the text. Next chapter covers a literature review focused on the categorization and sources of errors in machine tools. Moreover, the assembly process of machine tool is described, together with inspection procedures done at the manufacturer. Chapter 3 describes the background, motivation, hypothesis and scope of this work. In the next chapter the model of volumetric error, using homogenous transformation, based on the selected kinematic structure of machine tools is presented. The idea of propagation of kinematic errors through the structure to the final volumetric error is described. A new metrics for the analysis of a single kinematic error impact on the maximal volumetric error has been introduced. In chapter 5, a model of transformation of geometric errors of guideway system to kinematic errors and its experimental verification, based on measurements of selected components, is presented. Furthermore, the influence of components mass on the kinematic errors was analyzed. Next chapters constitutes

a formulation of assembly problem, in which there exists a population of available mechanical components. In the work, systematic and random search algorithms as well as metaheuristics: simulated annealing and genetic evolution were used to find the most convenient solution, where criterion was the maximal volumetric error for each assembled machine tool. The performance analysis was conducted and the results were commented in the thesis. Chapter 7 contains the findings and the prospects of further research in the field. Next chapter is the list of the references that were cited in the text. Final chapter consists of appendixes to this work, that contain script fragments in Wolphram Mathematica, that were developed for the devised models.

The subject of this dissertation is the issue of determining the accuracy and repeatability of industrial robots positioning. The dissertation presents research that led to the development of new, rapid method of measurement accuracy and repeatability of industrial robots