Preliminary Considerations Regarding Modernization of the Driving, CNC Control and Measurement Systems of a Lathe Model UBC 150 RAFAMET

Ghionea A. [1,], Ghionea I. [2], Cioboata D.[3], Savu M.[4]*

Abstract: *In specialized literature are presented results of many researches in the field of remanufacturing of machine tools, some of which are referring to specialized lathes. Lathes for processing the wheels and wheelsets of the railway vehicles were diversified and modernized in accordance with the requirements of railway transport. The paper presents the preliminary stages of theoretical and applied research on modernization of a conventional lathe with two working units. This ensures adaptation of four kinematic chains for CNC advance/positioning and improvements of translation couplings, adaptation of CNC equipment for driving and measuring simultaneous both wheels mounted on axle, reducing of geometric errors of running profile processing. The modernization process also involves restoration of functional requirements and measurement of the lathe geometric precision. The new data referring to speed for advance and positioning range will be established, with higher values than for the conventional version. The final results of steps for modernization of the lathe also allow improvement of the data sheet, called Reshaping Protocol.*

Keywords: railway wheel profile, CNC lathe modernization, kinematic structure, turning parameters, railway wheel re-profiling, wheelset

1 INTRODUCTION

The wheels are the most loaded components of railway vehicles [6], [10], being subject to a continuous process of wear due to difficult operating conditions: load, modification of rail and of the wheel profile, temperature variations, curved paths, variations of speed, breakings, etc. When the wheels reach a certain critical level of wear, they must be re-profiled or replaced [19], when the adding removal material exceeds a certain limit. Using wheels with appropriate profile reduce the risk of derailment and minimizes the dynamic interaction between the vehicle and the track, reducing noise, vibration and wear.

The development of rail transport in present focus on increasing the reliability of rolling stock and traffic safety, operating costs reduction, improvement of the manufacturing technologies and control and maintenance possibilities, reduction of noise and wear in operation [22]. Framing the rolling profile of the railway vehicle wheels into the geometric and functional dimensions are ruled by national and international standards [11], [16] [18], [19].

Re-profiling of the wheels after a certain period of operation is imposed following a control phase which is an important part of the rolling stock maintenance.

Modern approaches required the development and implementation of automated equipment for manufacturing and measuring of wheels running profile, both static and dynamic.

Profiling and re-profiling of wheels are performed by turning technological processes on specialized machine tools [5], [21]. There are used three types of such machine tools, namely: conventional, portal and under-floor. Due to the high cost for acquisition of such a modern machine tool, is required, as appropriate, remanufacturing [4] of existing machine tools by adding driving, command and measurement systems.

The remanufacturing costs are soon recovered by increasing the productivity and profiling/ re-profiling accuracy [3], [14], [15].

This paper presents the main results of Stage I: "Studies and analyses of the technological system for profiling/ re-profiling and measurement of machined surfaces of the train wheels". There were defined many functional requirements of the lathe construction and of the measurement and command equipment within the project WheelReshaping PN-II-PT-PCCA-2015-4-1681 [21].

2 LATHE STRUCTURE. ELEMENTS, ASSEMBLIES AND COUPLINGS

UBC 150 RAFAMET lathe (Fig. 1) [20] is a machine tool that processes the running surfaces of wheelset in a single clamping, having two working units (2). Each unit has in its structure two radial sledges (3), a longitudinal sledge (4) and a transversal sledge (5).

This last sledge supports the other ones on linear guidance. For processing, sledges (3) and (4) are doing the advance/positioning movement and sledge (5) is doing positioning movement when the wheel diameters range of the axle (10) is changed.

The driving sledges are as follows: in advance movement with an electric motor with variable speed (6) and in positioning movement with a constant speed motor.

Function of the reversal movement is achieved by an inverting mechanism with gear and electromagnetic coupling. The wheelset is driven in rotation with the cutting speed n_c, simultaneously at both ends by a rotating device (12). The faceplate drive mechanisms are located in each assembly (1), hereafter noted HS_1, respectively, HS_2.

To process the running surfaces, for each radial sledge is used a copying system (9), with electrical contacts [7], port program being type template with open contour.

Figure 2 shows the main view of the lathe in which are represented and noted the basic couplings for translating movement (T) and rotation (R).