PROPOSAL OF MEASURING FIXTURE FOR SERIAL PRODUCTION

KATARINA BREZIKOVA, MICHAL HATALA, JAN DUPLAK, DUSAN MITAL, SVETLANA RADCHENKO, FRANTISEK BOTKO

Technical University Kosice

Faculty of manufacturing technologies with a seat in Presov
Presov, Slovak Republic

DOI: 10.17973/MMSJ.2016_10_201658

e-mail: frantisek.botko@tuke.sk

Presented article is focused on monitoring of output control. Primary objective of research was design of most effective automated control of output quality for designated product. Proposal of fixture for output control was chosen as way to achieve main objective. According to performed practical analyse was intended final proposal of measuring fixture for chosen product. Manufacturing companies constantly face the problem of operational production processes and systems aimed to achieve demanded manufacturing costs of high quality products and minimizing of consumed resources. Production quality is essential in the field of intensive and emerging strategic industrial sectors as automotive, aviation, cosmonautics, energy industry, medical technology, micro-manufacturing, electronics and mechatronics. Obtaining of objective overall production quality is conditional by innovative and integrated quality, manufacturing logistics, effective maintenance, management and control methods.

KEYWORDS

measurement, fixture, design, clamp, component

1 INTRODUCTION

Identification of whole experiment was based on analyzing controlled product, which was dedicated for output quality control. 3D model of given component was constructed using CAD software PTC Creo 2.0 in application environment PTC Creo Parametric (data can be shared also with other CAD systems). Construction data with preservation of design intent as elements of 2D and 3D is possible to drag between each application. Users can very simple switch parametric or explicit method of modeling [[Dobransky 2013, Hutyrova 2016].

PTC Creo Parametric contains wealth of features for fulfilling wide range of tasks. Fixture design was created using functions of 3D modeling environment (for creation of individual parts), assembly function (configuration of individual parts into the assembly) and subsequently was used rendering environment (addition of visual effects to all necessary parts) [Zajac 2014].

According to technical drawings and information was created 3D model of dedicated controlled component. Also all parts of 3D measuring machine were transferred to 3D environment including the automatic-motoric rotary and tilting sensor head with a ruby tip. Main aim of research was proposal of control fixture for multiple parts control on 3D measuring machine, thus as other parts it was created in 3D environment [Zivcak 2009].

All individual parts were grouped together using function "assembly" to achieve visualization of proposed concept of controlling fixture. Better visual representation was obtained using "rendering" function, which gives realistic look to modeled components [Valicek 2012].

2 COMPONENT

Presented component is used mainly in automotive industry as assembly housing for impact pivot (Fig.1). Semi product for manufacturing of selected component is aluminium alloy bar [Dobransky 2015]. Aluminium alloys have wide spectral usage due to material properties as listed:

- Low density, which is one third of steel density, is essential for easiness of mass,
- Increasing strength and reducing brittleness at low temperatures; opposite effect of high temperature strength,
- Corrosion resistance,
- Recyclable without loss of quality,
- Simple joining by welding.

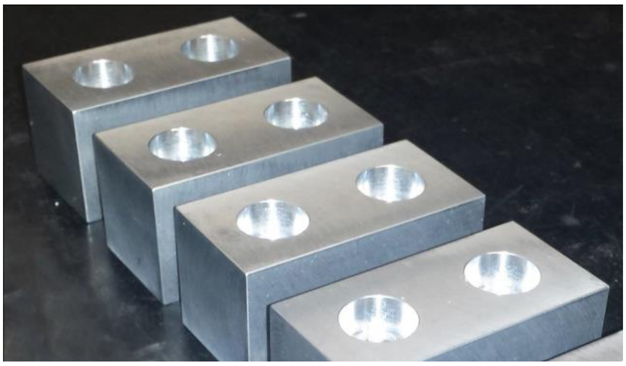

Figure 1. Measured component

3 PROPOSAL OF MEASURING FIXTURE

Base plate has to fulfill multiple duties from functional and measuring point of view. In the first place maintain dimensional width and length not to exceed the measurement range of the machine [Duplak 2014, Vojtko 2014].

Having noted the size of the measuring range has been calculated maximum number of products in one clamping in a single measuring cycle. Relative position, distance and orientation of the individual components with each other has been calculated due to several aspects, but a crucial one was allowed size for maneuverability probe in axes X and Y when measured at right angles to the horizontal hole, which amounted to 170 mm. In terms of time savings and dimensional been deployed components designed in three rows, i.e. the extreme end of Single- of 5 units face facing the inside of the board and in the middle was fastened with two rows of 10 pieces components oriented to the extreme-array components.

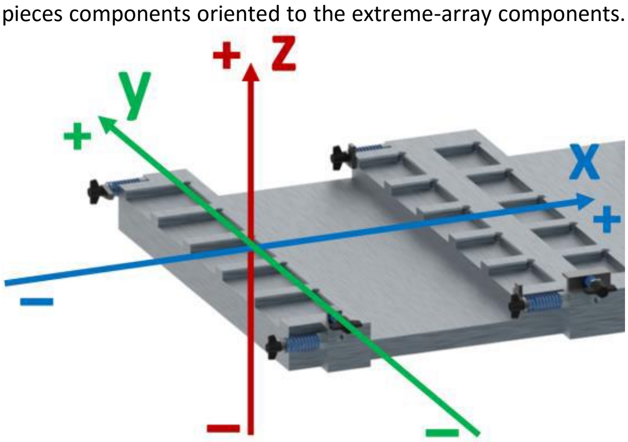

Figure 2. Base plate

This arrangement was achieved form two measuring spaces for a touch sensor, which ensure the saving of time and energy. Due to size of automatic -motorized turning tilting head had to be all series parts raised above the base plate about the level of 25 mm (Figs.2 and Fig.3).

The shape and dimensions of the raised rows is adapted to the fact that they rest against the movable parts of the product fixation to prevent the movement of the product in the measurement. These dimensions are adapted to be met in any case the edges orientated in the z direction, i.e., edge of the base plate and the movable edge of the fusing unit to be full force clamping screws transferred to the contact point of the fusing unit and the parts.

The final design was a modification plate puts the threaded holes for mounting the clamping screws.

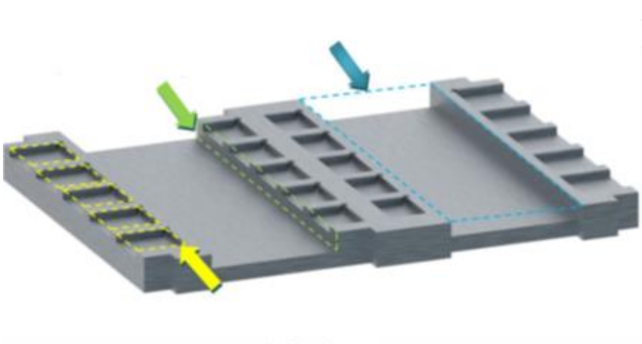

Figure 3. Parts of the fixture

The fixating parts of the measuring fixture have been designed to fully fix the component in all possible directions. For capacity reasons components on the base plate created two different types of fixing parts, one for extreme stocking components and one for the central shoulder. Both types of these parts have to ensure semantic point of view on the same functions.

The shape of the central fusing unit is adapted to distribution of parts so that attach it to the base plate has been limited dimensions of components and hence the holes in the plate are dimensionally sized larger than the external dimensions of the parts. To enable measurement face opening was one side of the board left open and the other side open only partly due to the pressing its function. Making the opening for probe a machine create space closed by peer fixation plates in five places in the axis of parts holes. This section provides a total of three main functional areas, respectively. Three hits, two of which are directly part of the board and the final touch was achieved by adding other T shaped components. (Fig.4)

Figure 4. Floating parts of fixture

Preventing components movement in the negative direction in the Y axis has been achieved using two edges of the fusing unit, which have been modified to come into contact with components on only two points. Two-point clamping is accurate in practical terms, because of possible inaccuracies walls and squaring for the accuracy of these touches clamping are rubber coated. For complete mounting components in the assembly are incorporated in the component fixed to the T-plate fixation screw connection. These T - units include single-point touch of hard rubber adjacent to the parts from the top. This prevents movement in the Z-axis Mounting fusing part of the preparation of the base plate product is implemented using three clamping screws.

Measuring fixture contains a total of nine clamping screws in four different designs and two design proposals by way of clamping. Composition is the same, with a few differences in the transposition of the technical elements. Each contains elements such as jaw, spring, butterfly screw and lantern assembly and disassembly of the clamping screw to the baseplate.

One design proposal clamping screws ensure the movement of the fusing unit in the X-axis, and thus ensure the parts moving in the positive and negative direction of the axis. The clamping screw is composed of interlocking L-shaped jaw which fixes the movable locking portion preparation from the top and sides and its content is also hollow roll with an internal thread. The roller is pushed over the spring, supported by the outer edge of the jaw on one side and on the outer wall of the intermediate piece on the other. Bow tie is twisted through a spacer which is fixed on the base plate, connected to the roller screw of the jaw and the rotary movement causes the translational movement of the jaw. Specifically, the two versions described clamping elements are shown in figure below (Fig.5).

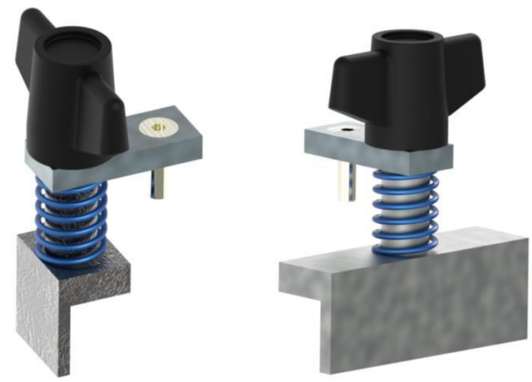

Figure 5. Clamping elements

Second structural design of clamping elements ensures the movement of the fusing unit in the Y-direction, and thus ensures the parts moving in the positive and negative direction of the axis (Fig.6).

Figure 6. Clamping elements

The second draft of the clamping screw is composed of intermediate units are installed securely in the base plate containing a roller with an internal thread into which the screw is screwed butterfly. Between intermediate piece and a bow tie is hedging L-shaped jaw which fixes the movable locking portion preparation only from the front. Two versions of the structural design of the clamping elements can be seen in the figure below.

4 CONCLUSIONS

For effective use of the proposed machine was designed to measure the numerous product clamping components and thanks to the Machine will be possible to check in one measurement cycle. Visualization of proposed measuring fixture is sown on Figs 7 and 8.

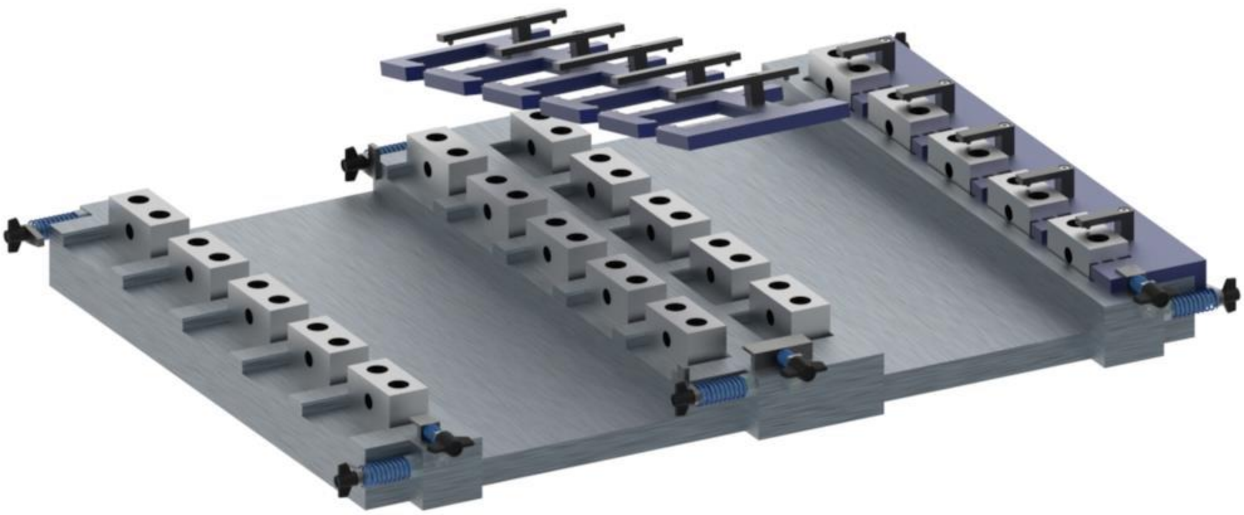

Figure 7. Measuring fixture

The composition is designed so that its dimensions do not exceed the operating temperature of the machine itself. Complete assembly and detail view during the measurement

Process automatically motor-head with the probe shows the subsequent image.

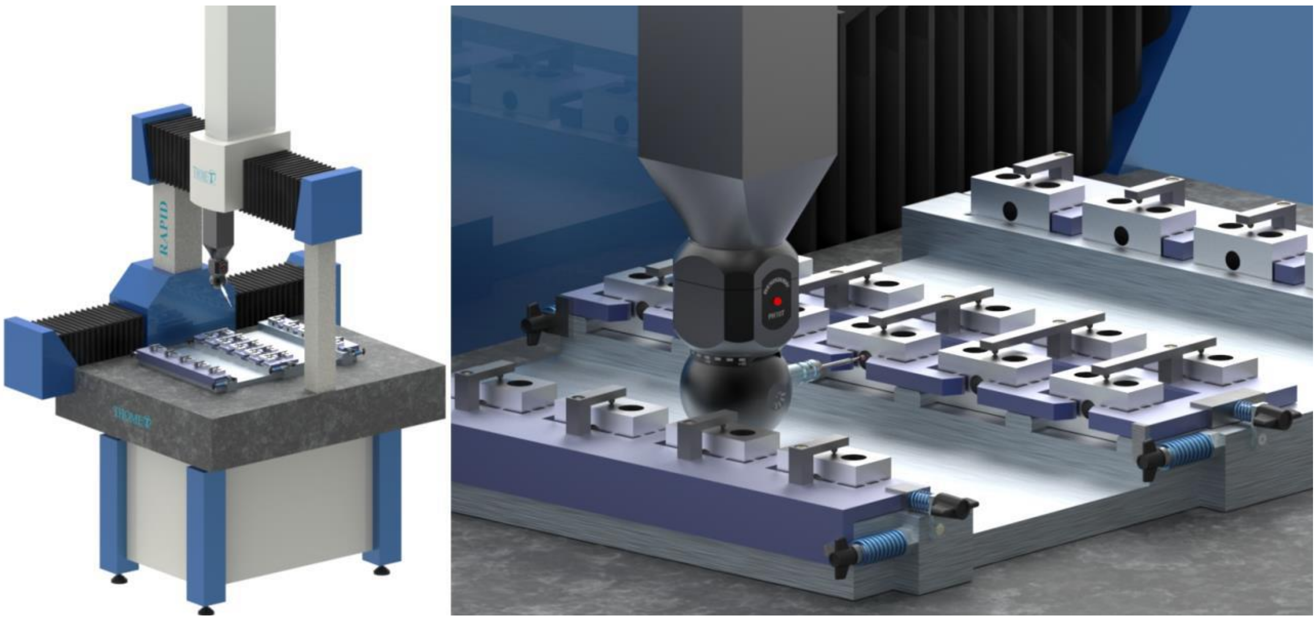

Figure 8. Visualization of measurement

This solution has an impact on the time saving and saving financial costs from different perspectives. One is the higher product quality, and thus less reversibility by consumers. Lower costs of repair, replacement, disposal, re-dispatch or storage are contribution to company in economic terms. Another example is the lack of savings in the cost of employing quality controller intended solely for manual measurements which would be represented by one of the trained employees. Retraining workers for the operator measuring machine Thome

Rapid Precision at certain intervals in addition to the performance of another work

ACKNOWLEDGMENTS

This paper has been elaborated in the framework of the project VEGA 1/0492/16 and 1/0619/15.

REFERENCES:

[Dobransky 2013] Dobransky, J., Mikus, R., Ruzbarsky, J. Comparison of Cooling Variants by Simulation Software. Advanced Materials Research, 2013, Vol. 801, pp. 75-80. ISSN 1022-6680.

[Dobransky 2015] Dobransky, J. et al. Examination of Material Manufactured by Direct Metal Laser Sintering (DMLS). Metalurgija, 2015, Vol. 54, No. 3, pp. 477-480. ISSN 0543-5846.

[Duplak 2014] Duplak, J. MIchalik, P. Kormos, M. et al. Impact of Cutting Speed on the Resultant Cutting Tools Durability in Turning Process of Steel 100CrMn6, in: S. Fabian, T. Krenicky (Eds.), Operation and diagnostics of machines and production systems operational states II., 2014, pp. 292-299.

[Hutyrova 2016] Hutyrova, Z. and Orlovsky, I. Assessment of micro-geometric and macro-geometric parameters after machining composite material with natural fibres, in: S. Fabian, T. Krenicky (Eds.), Operation and Diagnostics of Machines and Production Systems Operational States II book series: Applied Mechanics and Materials, 2014, pp. 267-283.

[Valicek 2012] Valicek, J., Drzik, M., Hryniewicz, T. Non-Contact Method for Surface Roughness Measurement After Machining, Measurement Science Review. 12 (2012) 184-188.

[Vojtko 2014] Vojtko, I., Simkulet, V., Baron, P. et al. Microstructural Characteristics Investigation of the Chip-Making Process after Machining,in: S. Fabian, T. Krenicky (Eds.), Operation and Diagnostics of Machines and Production Systems Operational States II book series: Applied Mechanics and Materials, 2014, pp. 344-350.

[Zajac 2014] Zajac, J., Mital, D., Michalik, P. Verification of process fluids in mass production,in: J. Kundrat, Z. Maros (Eds.), Precision Machining VII Book series: Key Engineering Materials, 2014, pp. 554-559.

[Zivcak 2009] Zivcak, J., Petrik, M., Hudak, R. et al. Embedded Tensile Strenght Test Machine FM1000-An Upgrade of Measurement and Control, in: Z. Gosiewski, Z. Kulesza (Eds.), Mechatronic systems and materials III., Book Series: Solid State Phenomena, 2009, pp. 657-662.

CONTACTS:

Ing. Katarina Brezikova
doc. Ing. Michal Hatala, PhD
Ing. Jan Duplak, PhD
Ing. Dusan Mital, PhD
Svetlana Radchenko
Ing. Frantisek Botko
Technical University in Kosice with a seat in Presov
Faculty of manufacturing technologies
Bayerova1, 080 01, Presov, Slovak Republic
e-mail: Katarina.brezikova@tuke.sk
e-mail:michal.hatala@tuke.sk
e-mail: jan.duplak@tuke.sk
e-mail: dusan.mital@tuke.sk
e-mail: svetlana.radchenko@tuke.sk
e-mail: frantisek.botko@tuke.sk