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RAPID DEVELOPMENT OF PRESSER FOOT BASE PRODUCTS: A REVERSE ENGINEERING APPROACH

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Abstract: *The worn-out of different components of textile machines can conduct to deterioration or even failure, which may have a negative impact on their effectiveness. If such spare parts can not be found on the market, a possibility of their redesign and manufacture is the use of a reverse engineering approach. In order to apply reverse engineering, the points cloud that defines the physical part must be first obtained. The points cloud of the real part is then transferred to a dedicated redesign program to redesign the 3D model of the piece. Finally, the redesigned part is manufactured using rapid prototyping techniques. The aim of this paper is to present the application of a reverse engineering approach for the redesign and manufacture of the presser foot base for sewing machines. The Shining 3D Scanner was used to scan the part, and the redesign of the part was achieved using the ShiningForm XOR software. The part was manufactured using the Inspire 200 3D printer, and the quality inspection of the manufactured part was carried out using the ShiningForm XOV software. The use of the reverse engineering approach allows the rapid development of parts with complex geometry, acceptable quality and relatively lower manufacturing costs.*

Key words: *reverse engineering, textile machines components, digitization, rapid prototyping, quality inspection*

1. INTRODUCTION

Different components of textile machines operate under dynamic and vibration conditions that may conduct to their worn-out. As a result, the state of these parts can deteriorate or even fail, which may have a negative impact on their effectiveness. If such spare components are not available on the market, a reverse engineering approach can be used for their replacement [1], which is based on digitization and rapid prototyping processes [2].

The digitization process is employed to transfer the physical part to digital form by using specific equipment such as coordinate measuring machine (CMM) or 3D scanners to acquire the points cloud that defines the real part [3]. Then, the points cloud is transferred to a dedicated redesign software where these points are cleaned, connected, and converted into the 3D model of the part [3, 4]. The behavior of the resulting part under different working conditions can also be studied through finite element analysis and if necessary, the part can be modified [5]. Finally, the redesigned part is manufactured using rapid prototyping processes [2]. The quality inspection can be achieved

by comparing the 3D model of the redesigned part with the scanned data of the manufactured part using dedicated software [5].

Within the above-described framework, this paper aims to present the employment of a reverse engineering approach to redesign and manufacture the presser foot base for sewing machines.

2. MATERIALS AND METHODS

The study was conducted using the reverse engineering system depicted in figure 1 [6]. This system includes the Shining3D Scaner, the products redesign software ShiningForm XOR, the Inspire 200 3D printing and the ShiningForm XOV software for quality inspection. The ABS material is used for the manufacturing of products by Inspire 200 3D printing.

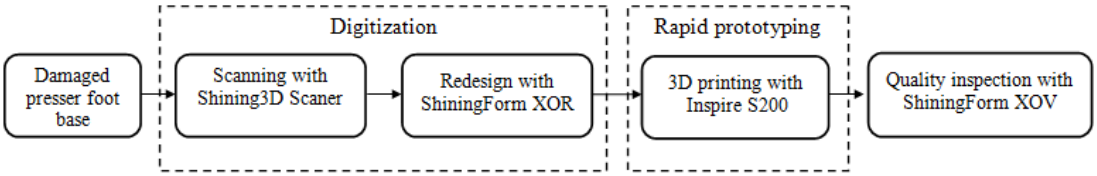

Fig. 1:The reverse engineering system [6]

3. RESULTS

The automatically scanning option of the Shining3D Scaner was used to scan the presser foot base part, which was placed on turntable of the reverse engineering system. The resulting points cloud is illustrated in figure 2. In order to be transferred to the redesign software, the points cloud was exported into a ".rge" format.

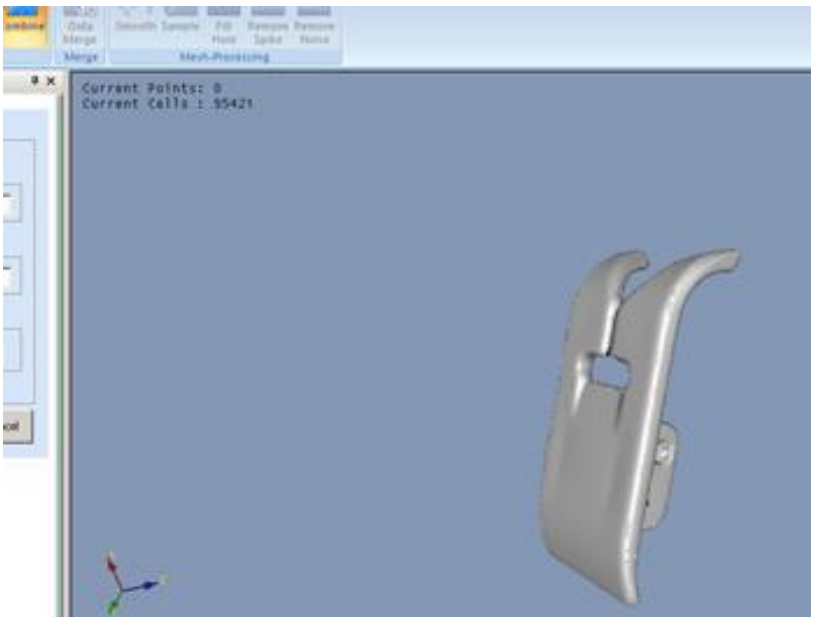

Fig. 2: The points cloud of the scanned part

The redesign of the part was performed through the ShiningForm XOR software, which allows the import of the ".rge" format of the points cloud. Finally, the 3D model of the redesigned part was obtained (figure 3).

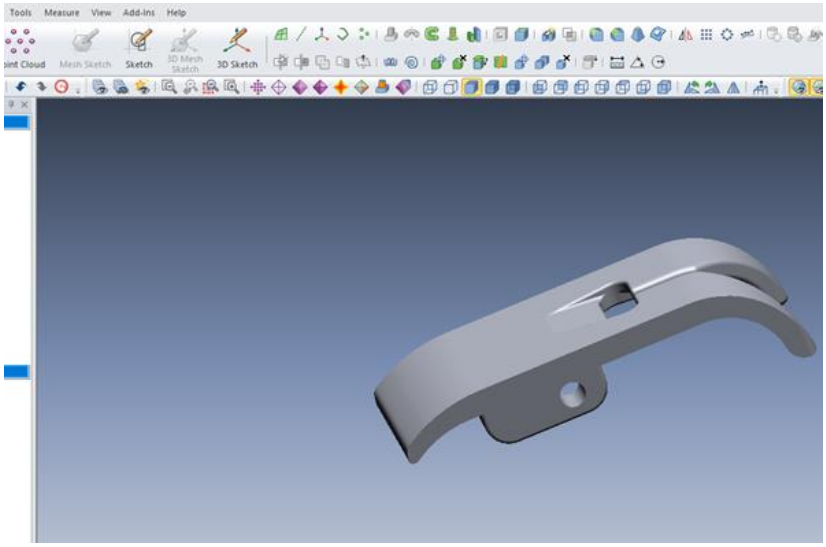

Fig. 3: The 3D model of the redesigned part with ShiningForm XOR software

The ShiningForm XOR does not provide the possibility to save the 3D model of the redesigned part in a ".stl" format to be manufactured with the Inspire 200 3D printer. For this reason, the 3D model of the part was exported from ShiningForm XOR in a ".stp" format, which was then converted in a ".stl" format using Solid Edge software. Figure 4 depicts the result of the 3D printing of the redesigned part.

Fig. 4: The redesigned product manufactured with Inspire 200 3D printing

The ShiningForm XOV software was employed for quality inspection of the manufactured part by comparing its scanned data with the 3D model of the redesigned part. Figure 5 presents the result of this process.

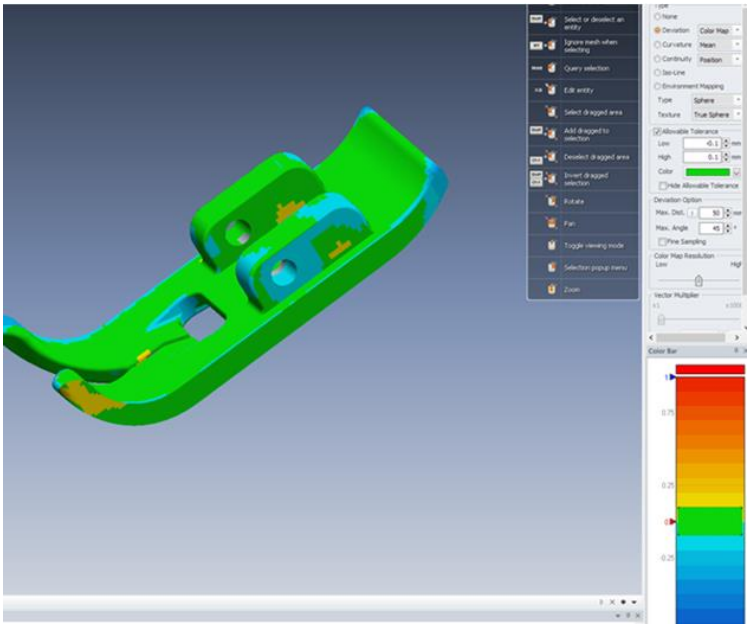

Fig. 5: The quality inspection with ShiningForm XOV software

4. CONCLUSIONS

In this paper, a reverse engineering approach was employed for the rapid development of presser foot base products. The use of such approach allows the rapid development of textile machines components with complex geometry, acceptable quality and relatively lower manufacturing costs.

REFERENCES

[1] F. Buonamici, M. Carfagni, R. Furferi, L. Governi, A. Lapini, Y. Volpe, "*Reverse engineering modeling methods and tools: a survey*", Computer-Aided Design & Applications, 15(3), pp. 443-464, 2018.

[2] M. Dúbravčík, Š. Kender, "*Application of reverse engineering techniques in mechanics system services*", Procedia Engineering, 48, pp. 96-04, 2012.

[3] Z. Geng, B. Bidanda, "*Review of reverse engineering systems-current state of the art*", Virtual and Physical Prototyping, 12(2), pp. 161-172, 2017.

[4] A. Elizondo, F. Reinert, "Limits and hurdles of Reverse Engineering for the replication of parts by Additive Manufacturing (Selective Laser Melting)", Procedia Manufacturing, 41, pp. 1009-1016, 2019.

[5] V. Tut, A. Tulcan, C. Cosma, I. Serban, "*Application of CAD/CAM/FEA, reverse engineering and rapid prototyping in manufacturing industry*", International Journal of Mechanics, 4(4), pp. 79-86, 2010.

[6] M. Baban, C.F. Baban, T. Buidos, I. Stanasel, "*A reverse engineering approach for the products development*", Nonconventional Technologies Review, 19(1), pp.12-17, 2015.