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Application of reverse engineering techniques in mechanics system services

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Abstract

In today's industry and production systems it's important to do mechanics or measurements systems services regularly. In case of damages it is required to eliminate these in shortest time period, to avoid time losses and obviously also financial losses. In case of destructive failure of devices, or their parts it is required to change them for new one. However, nowadays we know various types of techniques which are available for substitution of damaged parts in very short time period. One section of these techniques is reverse engineering. Especially techniques like 3D scanning and rapid prototyping. Submitted article analyse reverse engineering techniques utilizable for mechanics or measurements system services.

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1. Introduction

Reverse engineering (RE) methods are representing important part of prototypes creation [3]. Big companies are investing in RE for decreasing of competitiveness, decreasing of time needed for prototypes creation and also for decreasing of time needed for real product production. There are many reasons for using RE. Base criterion for choosing RE as creation method is absence of digital 3D CAD model. Application possibilities of RE increasing parallel with developing of hardware and software which is used for products creation and design. Examples of these techniques application are for example real products digitizing, CAD model with produced product comparison or machine settings via CAM systems after digital measurement.

Reverse engineering application in automotive industry is integral part of car creation processes. 3D scanners are most used by design part of car. It would be time-consuming and difficult to transfer real designer's car model into 3D CAD model without 3D scanning. This process decrease to minimum with help of 3D scanner technologies and the designer can transfer his design in few minutes to CAD software.

Classic machine process begins from CAD model and ends by component production. RE process is opposite. At the beginning is real component and it ends with digital model (fig.1).

One from many options to use RE is using it for service operations in production. Classic service process by device malfunction is trying to repair it in shortest time, or changing of damaged part. Though, part changing can take some time

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when there aren't any spare parts available. That's unacceptable in production process. So here is option to use RE and rapid prototyping for decreasing the repair time to minimum.

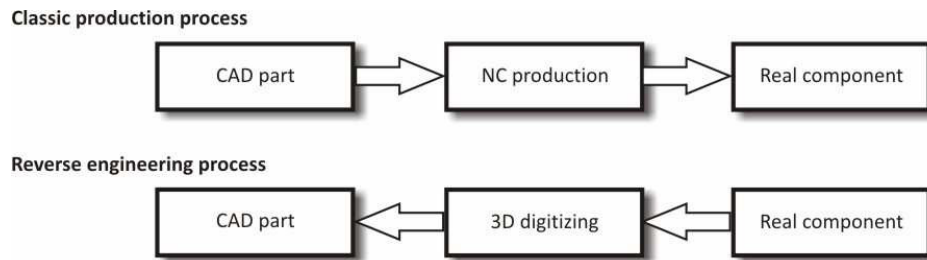


Fig. 1 Reverse engineering and classic production processes comparison

2. Innovative techniques and tools for working out

Main techniques used by reverse engineering are *digitizing* and *rapid prototyping*.

2.1. Digitizing

Digitizing processes allow us to transfer real part surfaces to digital form. Depending on used technique, principle of digitizing is to scan points in space and they output in CAD software. Main type of digitizing processes is the 3D scanning [4].

3D scanning is a method which allows us transferring scanned points from space to CAD software and to utilize them. There are more types of digitizing devices that allow this transfer. Main types are:

- optical
- laser
- contact
- destructive

Fastest and in machine industry most used are laser and optical 3D scan devices. These devices allow us to scan shapes of the real parts with machine industry precision demands.

There is measurement device FARO with laser scan probe FARO Laser ScanArm (fig. 1) used on automotive production department of Technical university of Kosice. This device used a group of sensorial parts in its arms for exact determination of probe position in space. Additional scan probe ScanArm is using a laser ray beamed from device and projected on scanned part surface. Projected laser ray is afterwards scanned with high sensitive CCD cam. Laser ray projection (fig. 2) distance in space is automatically re-counted in dependence on angle and distance of device probe. This kind of progress can determinate a position of several thousand of points in seconds. This is rapidly increasing the 3D scanning process in comparison to contact 3D scanning methods.



Fig. 1 FARO Platinum Arm with Laser ScanArm in Automotive production section Lab



Fig. 2 Laser beam projection line

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