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THE OBJECT´S DIGITIZING – THE REVERSE ENGINEERING PROCESS

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Abstrakt: The contribution deals with the Reverse Engineering Process, it´s meaning and exploitation and especially with 3D scanning of object.

Keywords: The Reverse Engineering Process, digitizing, clouds points, 3D scannin, surface.

1. THE REVERSE ENGINEERING PROCESS – IT´S MEANING AND EXPLOITATION

The Reverse Engineering Process (RE) is transformation proces the real object for the virtual model [1] – fig. 1.

Fig. 1 The Process Reverse Engineering [1]

The virtual model is able to have form:

- clouds points (the scanning datas), 3D curves,
- rapid surfaces, polygonal model, class A, technical surfaces,..

The difference between these surface´s models is in your accurancy, smoothness and intrusion surface.

Important **meaning** the RE is possibility obtain the 3D virtual model of different parts (big, small, complitated object), different size and shape. We can make on these virtual models different modifications, analyses (temperatures, fortresses,..) using to different CAD softwares.

Important areas **exploitations** the RE are:

- design and update the CAD models,
- the Rapid Prototyping Process,
- research the historical builds,
- movie, car, air and computer industry,
- health, ...

2. PROCESS OF THE OBJECT´S 3D DIGITIZING

The phase, which tranforming the real object for the virtual model is **3D digitizing** and necessary equipment for realization this phase is **scanner** [1].

3. SCANNER FOR THE OBJECT´S 3D DIGITIZING

We can divide the scanners by different aspects:

a) scanninng´s form of the surfaces the parts (the **contact** and **non - contact**),

b) mobility of scanners (**mobile** and **non – mobile**),

c) scanning´s surfaces (**internal** and **external** surfaces).

The contact scanners: 1. the measuring mobile hand **MicroScribe**, fig. 2 [11],

(for example) 2. the measuring mobile arm **FARO**, fig. 3 [4],

3. the destructive scanner **RE 1000**,

4. the stacionary 3D measuring machine **MORA MS 10**, fig. 4 [12].

Fig. 2 **MicroScribe**

The spike this scanner tauch scanning object – we have clouds points. Every points are designation with the 3 coordinates (x, y, z). The price this scanner is about 5000 $. It´s accurancy is 0,23 mm [22], [23].

Fig. 3 The measuring mobile arm **FARO**

The spike this scanner tauch scanning object – we have clouds points. Every points are designation with the 3 coordinates (x, y, z) – accurancy 0,05 mm. The scanner´s part is also the laser scanning hand – we can using to the scanner for non – contact scanning (accurancy 0,03 mm). The FARO is in the laboratory University of Žilina, Faculty of Mechanical Engineering, on the Department of Design and Mechanical Elements [7].

The destructive scanner **RE 1000** can scanning the internal and external surfaces. The scanning process run pas at the moment, when is removel the thin layer from scanning object. The scanning object is after scanning proces destroyed.

Fig. 4 The stacionary 3D measuring machine **MORA MS 10**

The spike this machine tauch measuring part. The stacionary 3D measuring machine is in the laboratory University of Žilina, Faculty of Mechanical Engineering, on the Department of Design and Mechanical Elements [7]. It´s accurancy is 0,002 mm. We have the special software: INCA 3D.

The non - contact scanners: 1. The laser scanner **MINOLTA VI – 900** fig. 5 [9],

(for example) 2. the optical scanner **ATOS** fig. 6 [10],

3. the rontgen 3D scanner [2],

4. the ultrasound 3D scanner **Freepoint** fig. 7[21].

Fig.5 The laser scanner **MINOLTA VI – 900**

The laser scanner **MINOLTA VI – 900,** fig. 5 is in laboratory on the Department of Design and Mechanical Elements [7]. It´s accurancy is 0,1 mm. The scanning distance is 0,6 – 1,2 m. The scanning object is lying on the rotate table.

Virtual object is possible transfer on the formats DXF, Wavefront, SoftImage, ASCII, VRML, OpenInventor a STL.

Fig.6 The optical scanner **ATOS**

The scanning object is scanned of several angles. Near every swing out is object scanning. It´s accurancy is 0,1 – 0,2 mm.

Fig.7 The ultrasound 3D scanner **Freepoint**

It´s accurancy is 0,3 – 0,5 mm.

4. THE SOFTWARES FOR THE PROCESSING THE SCANNING DATAS

The dates (clouds poinds), which were scanning are processing in special **software** [1] **–** we have the virtual model.

The special softwares (SW) are by functions:

- SW for High End aplication ,
- SW for Polygonal Modeling and Rapid Surfacing.

The best know **softwares** are: **Image Surfacer** (CAN) [19]**, Paraform** [20]**, PolyWorks** [11]**, Geomegic Studio** (USA) [3]**, Cyslise** [14]**, CopyCAD** (GBR) [15]**, Imageware** (JPN) [16]**, RapidForm** (KOREA) [17]**, PixForm** (JPN) [18]**.**

Software PolyWorks is using to in laboratory on the Department of Design and Mechanical Elements [7].

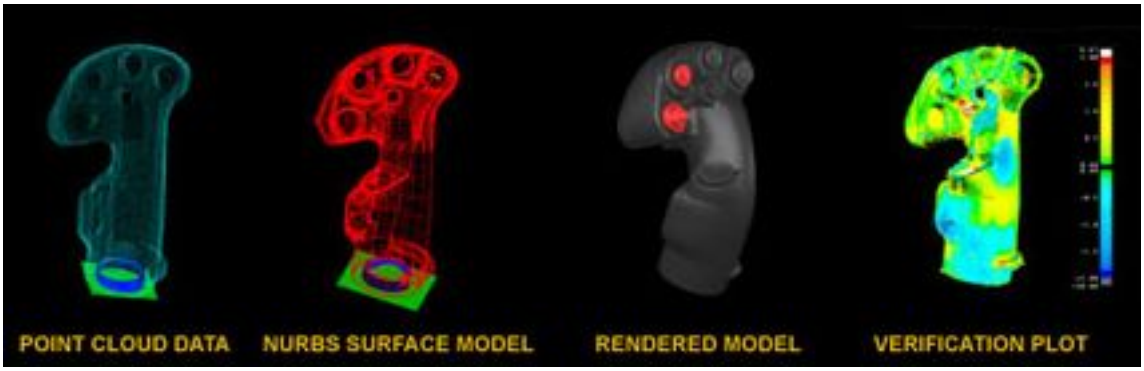

Fig.8 Image Surfacer software [21]

5. THE TOPIC OF MY DISERTATION WORK

Topic of my disertation work is RE. On my work compare different scanning method (contact – using to **FARO** and **MicroScribe** scanner [22] and non – contact scanning – using to laser

scanner **MINOLTA VI – 900** and **mobile measuring arm FARO with laser head**) [7] – I compare it´s accurency between model created with Catia (Pro/Engineer) and model created with scanner. I´m scanning and measuring the parts for different Universities (Novi Sad, Žilina, Trnava, Poznan, Kraków), which are on the fig. 9.

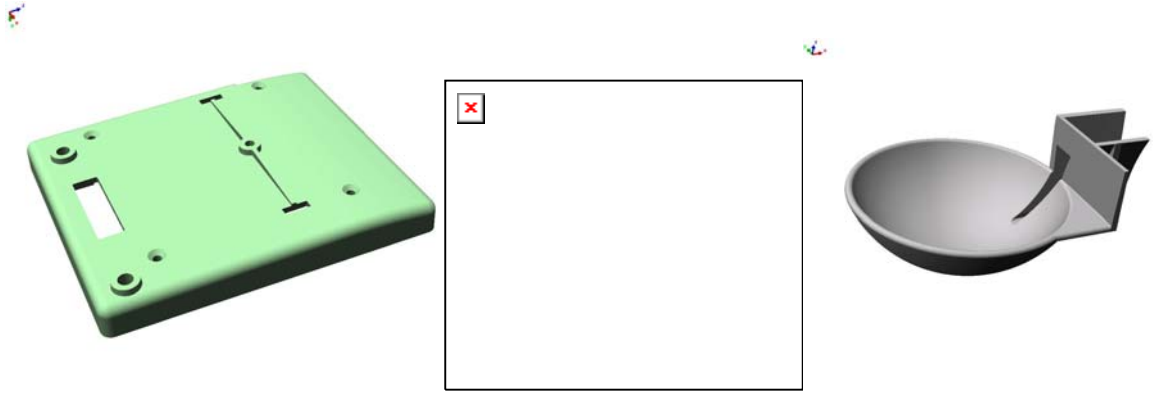

Fig.9 The scannig parts

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6. THE LITERATURE

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