Establishing the 3D Profile of Vehicle Car Body Elements in the Virtual Environment

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Abstract. The paper deals with an issue that car researchers are facing increasingly more, related with how to virtually shape in specific software programs, the existing parts of interest from an real automotive body frame, in order to modify their digitized dimensions and afterwards optimized their design process to sustain real environment challenges, after virtual soft tuning impact with the programmed drag stress, knowing that over the speed of 120km/h more than 60% percent of engine power is used to face aerodynamic forces.

Keywords: automotive body frame, pressure, drag force, virtual environment simulation, modal analysis.

1 Introduction

Conducting research, relevant to the calculation pressure and down force air element body, bending moments of its various sections, interactions Air - structure to the bodywork elements of modal analysis of the bodywork, can be reliably and accurately performed only under vehicle operation simulating conditions with body frame panel's reconstruction in to a virtual environment.

2 Scan Method

To reconstitute the body parts must be obtained through great accuracy experimental means, a „multipoint values cloud", preloaded from the complex surfaces of the element in study, so by screen allow profiling of this element, the specialist should be able to perform its analysis and optimization in the virtual environment.

In this respect, the reconstruction in virtual environment of such an real element can be achieved using one of the following scanning methods (depending on the shape of the body frame panel in study).

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2.1 Mechanical Contact Scanning Reconstitution Method of the Automotive Body Part

This method is based on the equipment facilities DEA GLOBAL Performance of Italian Company's production DEA that use an electronically controlled mechanical scanning head which is able to take measurements point to point, by switching off the mechanical contact with the piece. The most powerful component of the measurement device is head unit is operated and automatic guidance system (computer controlled) with its magnetic detachable coupling probes.

Coordinates of the measured points scanned are taken automatically into a consisting device database. A screen capture of the scan parameters is shown in *Fig. 1*. The obtained data are saved in "Stl" format (*Fig. 2*) so as to reconstruct body parts the researcher can use the module *Digitized Shape Editor*.

Fig. 3 shows "the point cloud" generated by tracking the paths of measurement.

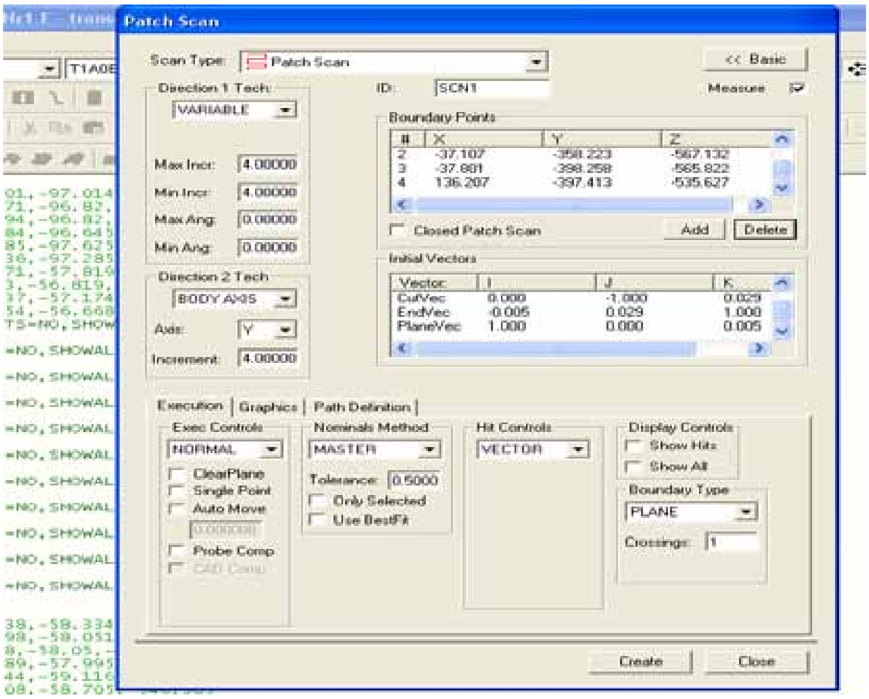

Fig. 1. Capture screen with the scan parameters

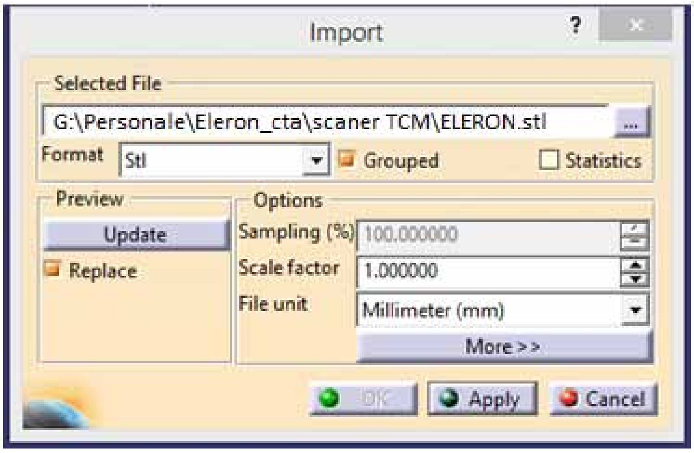

Fig. 2. Measured data in „stl." format

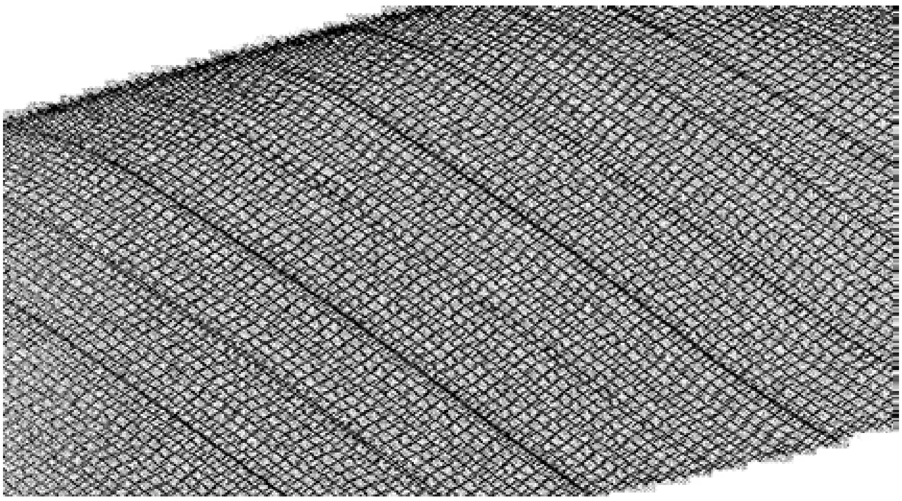

Fig. 3. Virtual measured points of the surface generated with tracking device

In case the element studied is too large, it is divided into sections (segments) with lengths that allow them access to the measuring device. The function used in the program Digitized Shape Editor for coupling sections is *Clouds Union* and, after coupling, to achieve the surface area of studied element (in this case an „*deport aerodynamic force wing*" we use *Mash Creation function*; Subsequently, the surfaces are sealed with *Surface Close function*, that give, finally, to the panel the shape of a solid model.

2.2 The Non-Contact Optical Scan Reconstitution Method of the Body Element

This method is based on the principle of photogrammetry and uses an apparatus made by the Swiss company FOBA AG from Zurich under the name Comet Wettswil L3D. Studied mechanical element is fixed to a base in a vise and on its surface we applied markings in the form of circles. Around this mounting system are horizontally placed several markers involved in specific position "points in the cloud" and two calibration bars, which ensures the accuracy of the calibration length by preserving the distance very accurately between the ends of the calibration rods – Fig. 4.

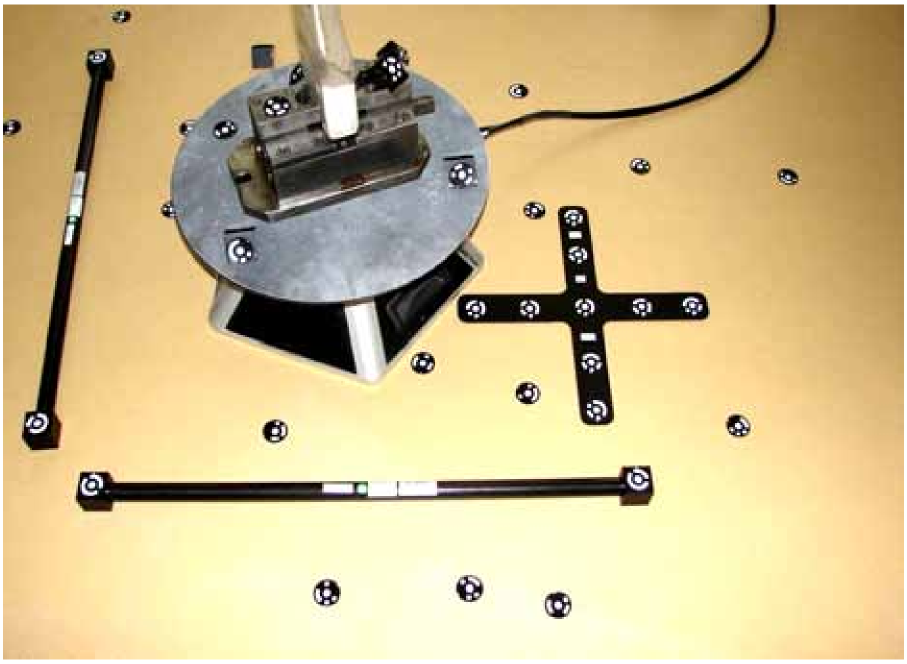

Fig. 4. Mark Calibration

Images taken on the photographed areas are retained on the magnetic picture memory cards and then later processed with specialized software, the final result being the 3D profile of the studied element.

2.3 Non-Contact Scanning with Structured Light and Triangulation in Method

For this type of scan we use the same aggregate Comet L3D. The body is placed on a rotating plate that allows rotation of the studied element from 45^0 to 45^0 such that, for one turn each area scanned with light structured data benefits from eight samples (*Fig. 5*). Values obtained by scanning are automatically introduced into the database of the device and the software *GEOMAG 2013 Qualify* give the three-dimensional image of the car body frame panel studied.

Fig. 5. Scanning aerodynamic wing element

Fig. 6. Deport of the aerodynamic force wing image constructed from the point cloud

Fig. 6 gives the visual reconstruction of the aerodynamic drag wing element consisting of "the point cloud" obtained by structured light scanning method. The final 3D image of the car frame wing element is achieved by smoothing the surfaces and "by soft-filling empty gaps" from the body surface as a result of the existence of the reference elements.

With the help of specialized software GEOMAG Qualify 2013 we could perform parallel sections, spaced along the beam studied and then we import the results as files to Catia V5 software with which we virtually shaped the profile of the aerodynamic wing studied. We combine and lineup of the 2D curves resulting from import geometry and on the basis of digital processing of these curves we had the possibility to 3D virtual environment generate the outer surface of the drag aerodynamic wing studied.

3 Conclusions

Thus, the reconstituted scan profile of the aerodynamic wing is a virtually properly soft replica surface of the real element studied, a *"digital copy" of the physical model*.

These results provide us, as researchers, security over our work and ensure that all vehicle body elements' investigation, carried out in a virtual environment, has high degree of credibility. Also all these scanning methods, credible source of 3D environment virtual profile extension can be extend related to any mechanical component of a modern vehicle.

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