Case Study

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Volkswagen AG, 38112 Braunschweig

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exaCT Computed Tomography in use at Volkswagen Braunschweig

Dimensional Analysis in Plastics Technology

At Volkswagen Braunschweig the department for quality assurance in plastics technology is responsible for initial sampling and the release of serial products for production. Therefore the highly complex and always in size decreasing products have to be tested continuously. The steadily increasing demands on quality of these products and on an allover documentation make the use of new technologies indispensable.

The complete analysis of these highly complex parts required different tactile and optical technologies. Furthermore some dimensions had to be measured with portable measuring instruments. To be able to provide a consistent analysis procedure even of these metrological challenging plastic parts, the industrial computed tomography system exaCT M from Wenzel Volumetrik (figure 1) has been put into use at the department for quality assurance in plastics technology at Volkswagen AG in Braunschweig, Germany.

Analysis of an adjustment wheel to regulate the airflow

The computed tomography workstation exaCT M provides ideal possibilities for metrological inspects of complex plastic parts. With tactile measuring systems a reliable measurement is in these cases oftentimes not possible. The parts are made of flexible material, are optical not accessible and because of their size difficult to clamp. Optical measurement procedures do not allow the measurement of inner structures and undercuts. The exaCT computed tomography is a non-contact and non-destructive technology which makes the holistic analysis of even very small flexible plastic parts with inner structures possible.

“The analysis and evaluation of adjustment wheels as they are used to regulate the airflow of the ventilation inside a car, is only one of numerous applications which we have to handle every day,” explains Hans-Jürgen Knosalla, head of the measuring room for plastics technology at Volkswagen. For this part, which is used for cars like Golf Plus and Tiguan, the dimensional evaluation is in the main focus (figure 2). The manufacturing dimensions are determined and checked accordingly to their accuracy to size.

A computed tomography evaluation always begins with capturing the scanned data. For the scanning procedure, where the part is turned on a rotary table by 360°, the part needs to be secured from shifting. As computed tomography is a non-contact measuring method a simple fixture can be used for this purpose. The fixture can be made of different materials with low density as for example rigid foam.

Automatic generation of volume models

During the scanning procedure two dimensional x-ray images are captured. These images are called projections. From a multiplicity of these projections, which consists of pixels, a three dimensional volume model is created. Volume models are made of voxels, these are three dimensional pixels. This procedure is fully automated and carried out in the background during the scanning procedure.

For metrological evaluations surface data is needed (figure 3). This data is automatically created after the scanning procedure is finished. Surface data consist of single triangles which describe the measured object´s surface detailed. It is the basis for all following evaluations and analyses.

Virtual Probing

The measuring procedure for dimensional evaluations is similar to well-known tactile measuring methods. The difference lies within the object used for probing. Using the tactile method the real part is the measured object, but when using CT for dimensional control the surface data of the scanned part is used for probing. So a virtual probing procedure is applied. This procedure has the advantages that a deformation of the part caused by probing cannot happen and there are no limitations caused by the probing sphere or shaft.

The measurement is carried out in the same way as it is known from tactile measurements. At the beginning the part needs to be aligned. Therefore the elements to be measured are selected in the CAD model and then the measuring points are placed via mouse click on the surface data (figure 4 and 5). After the first rough alignment the following measuring procedure can be carried out fully automated. According to the drawing all geometrical and free-form elements are measured and evaluated. For this process the complete functionality of the measuring software is available. The results can be reported either in a table or in a graphical report (figure 6 and 7).

The measuring method of virtual probing offers many advantages. On one hand there is unlimited access on the part. Smallest structures can be measured without any limitations caused by the probing sphere. Undercuts and inner structures can dimensionally be evaluated without destructing the part. Automatic measuring programs can be written and recalled every time a part of the series needs to be measured, just like it is known from tactile measuring machines. Furthermore a virtually unlimited number of measuring points can be selected without a noticeable increase of measuring time (figure 8).

Large measuring volume – little required space

The department for quality assurance in plastics technology also uses their exaCT M for the measurement of many parts of one kind. For this purpose they use one fixture for multiple parts. The parts are positioned symmetrically. This makes the following evaluation considerably easy. After the scanning procedure the data of the single parts is available. The single parts can be evaluated using a pallet measuring procedure. An existing measuring program is then applied on one part to begin with and repeated on all the other measuring objects.

“Since we have our computed tomography workstation exaCT M in use we were able to double our throughput of measured parts,” explains Hans-Jürgen Knosalla. “For the integration of a computed tomography system the required space of the system was crucial. The exaCT computed tomography systems had the best ratio of required space and measuring volume. Furthermore the data quality of the system was convincing.”

About WENZEL Group

WENZEL Group GmbH & Co. KG is one of the leading manufacturers of metrology solutions. The wide range of WENZEL products includes solutions in the fields of coordinate measuring machines, gear metrology, computed tomography and optical high speed scanning. The company has customers in many industries such as automotive and aerospace, mechanical engineering, as well as subcontractors operating in these sectors. Subsidiaries as well as sales and service partners worldwide represent the company in more than 50 countries. WENZEL Group employs more than 630 people.

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Image Overview

Figure 1: CT-Workstation exaCT M at Volkswagen AG in Braunschweig

Figure 2: Adjustment wheels to regulate airflow of ventilation inside a car

Figure 3: Surface data of an adjustment wheel

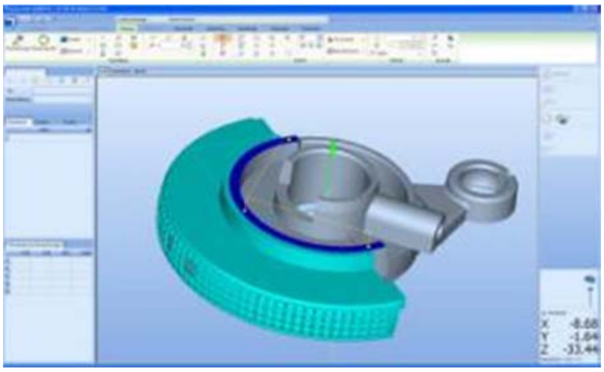

Figure 4: Element Selection for manual alignment in Metrosoft QUARTIS

Figure 5: Manually measured points on surface data

Messbericht Metrosoft QUARTIS®

Werkstück: 1
Zeichnung: XY-01234
Kommentar: Seite - Links
Messung: 2
Messungsdatum: 22.08.2012 13:24:01
Prüfer: Anwendungstechnik

Berichtsdatum: 07.09.2012

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ID		Elementtyp		Bezug	Tastpunkte	Spannweite	Beschreibung		
ID		Merkmalstyp			Wirklänge		Beschreibung		
	Nennwert	ISO 286	OTol	UTol		Istwert	Abw	%Abw	Grafik
CYL_1		Zylinder, Gauss, innen, getas			84	0.08			
SPH_1		Kugel, Gauss, innen, getaste			125	0.05			
AB_1.Lxy		Abstand Punkt-Gerade							
d	23.00		0.10	-0.10		22.96	-0.04	-36%	
PLN_1		Ebene, Gauss, getastet			5	0.02			
PLN_3		Ebene, Gauss, getastet			5	0.01			
Abstand_3.Lz		Abstand Punkt-Ebene							
d	3.40		0.10	-0.10		3.41	0.01	9%	
CYL_2		Zylinder, Gauss, innen, getas			96	0.05			
Zylinder_2.D		Durchmesser							
ø	2.27		0.05	-0.05		2.27	0.00	-5%	
CYL_1		Zylinder, Gauss, innen, getas			84	0.08			
Zylinder_3.D		Durchmesser							
ø	9.30		0.15	0.00		9.43	0.05	70%	

Figure 6: Measurement report, Metrosoft QUARTIS

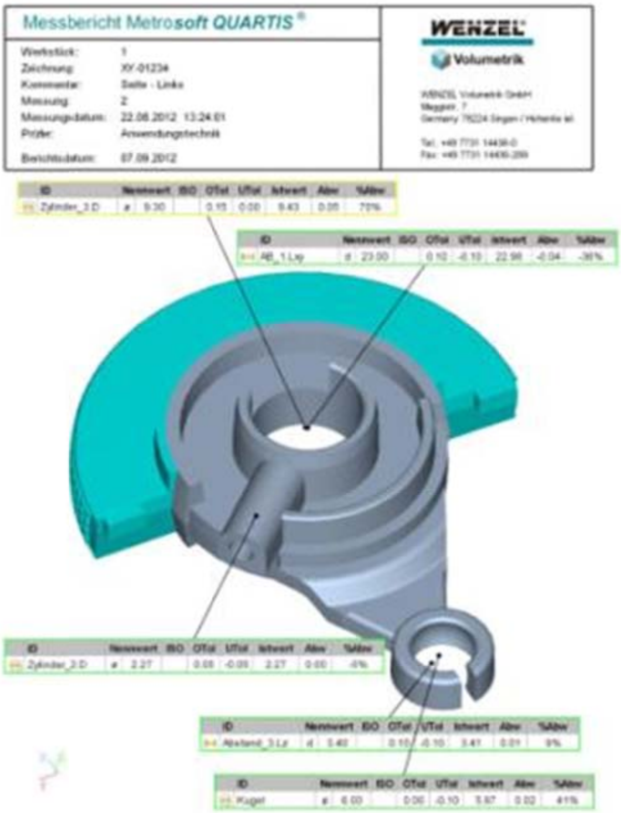

Figure 7: Graphical Measurement report, Metrosoft QUARTIS

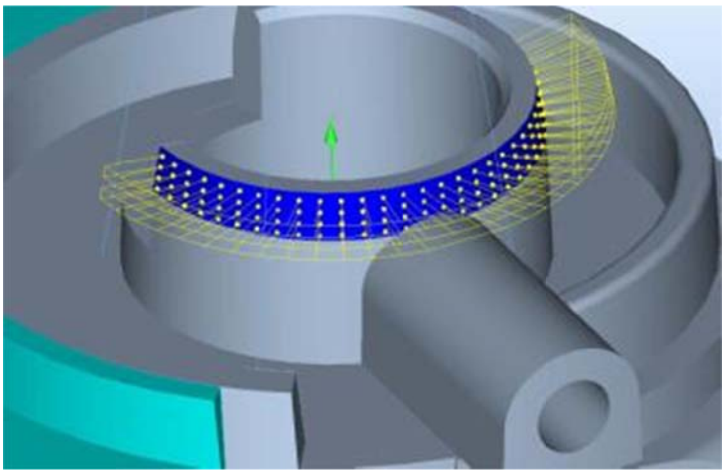

Figure 8: Automatic distribution of measurement points with Metrosoft QUARTIS