

Application Example: Quality Control

GOM Touch Probe for Casting Analysis

Messsysteme: ATOS, GOM Touch Probe

Keywords: Quality Control, Casting, Optical 3D Surface Measurement, Live Inspection, Deep Pockets, Touch Probing

The ATOS Optical Surface Measuring System is widely used within the casting industry for full field surface analysis of sand cores, patterns and casted parts. The GOM Touch Probe as an Add-On to the ATOS system offers the ideal combination of optical 3D freeform measurement and online tactile probing. Besides online alignment the GOM Touch Probe allows the smart measurement of optical hidden surfaces, live inspection of individual points with direct comparison to CAD as well as quick probing of primitives.



ATOS Optical 3D Measurement System

In casting applications the ATOS 3D Digitizer offers various advantages compared to traditional measuring techniques. The fast full field measuring technology of ATOS guarantees a fast validation of the object's complete and complex surface rather than just collecting a few points leaving large unknown areas (Fig. 1).

Based on the principle of triangulation the ATOS 3D Digitizer projects different fringe patterns onto the object which are recorded by two cameras (Fig. 2). The computer automatically calculates the 3D coordinates for each camera pixel of the scanned surfaces with very high precision and resolution. Each individual measurement takes approximately 1-2 seconds and is automatically transformed to a common object coordinate system using previously applied reference points. During measurement the software checks online for system calibration, sensor movement or any ambient changes that might affect the measurement.



Fig. 1: Measurement of a Pattern Plate with ATOS System



Fig. 2: ATOS Optical Measuring System for scanning casted parts

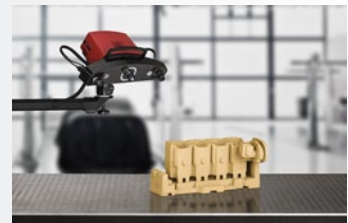


Fig. 3: Non-contact measuring of sand cores with ATOS

The ATOS 3D optical digitizer is mobile and can simply be transported to the object so that heavy casts, tools and models can be easily inspected right away on-site in foundries, tool- and die-shops (Fig. 2). Due to its robust design, the sensor head is built to perform in harsh and adverse production environments. As a non contact optical measuring device ATOS is also ideal to check sensitive sand cores before the casting process (Fig. 3).

The measuring volume can easily be adapted to specific measuring tasks and object sizes within a few minutes by interchangeable lens sets. Due to this flexibility, the ATOS system is able to measure objects of various sizes, from filigree injection-molding components to a complete aircraft. Turntables, robots or multiple axis motion units are available for automated measurement of multiple parts (Fig. 2).

ATOS Inspection Software

The ATOS Inspection Software provides a number of functions essential for the Casting Industry (Fig. 4). In addition to full field 3D shape and dimension analysis against CAD the software allows calculation of material thickness in order to check material allowance for further processing. It is possible to control size and position of basic primitives and also virtual calipers are included. Inspection sections with tolerance bands are available as well as classical 2D dimensioning tools. The ATOS reference point system allows moreover checking of parting surfaces for offset, fitting and proper closing of mould halves.

For documentation and further processing the ATOS Inspection Software includes enhanced reporting and documentation functions and interfaces in order to generate standard or customized 3D measuring reports or traditional tables with CMM points (Fig. 5). Results and deviations can be exported to various formats such as Excel, HTML, Word, etc.

For recurring measuring tasks the software evaluation can be automated using powerful macros and scripting language. GOM also provides the free ATOS 3D Viewer and such measuring results can be easily shared with customers or colleagues from other departments.

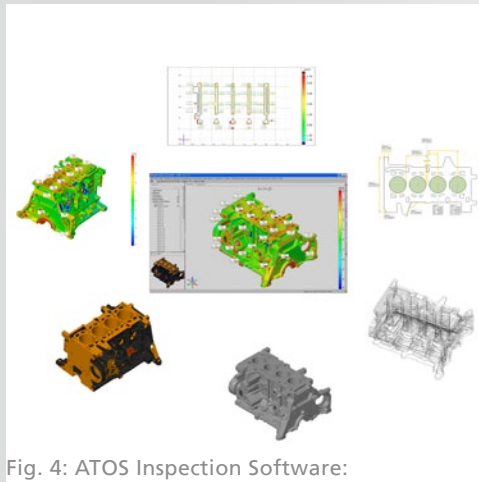


Fig. 4: ATOS Inspection Software: Evaluation examples

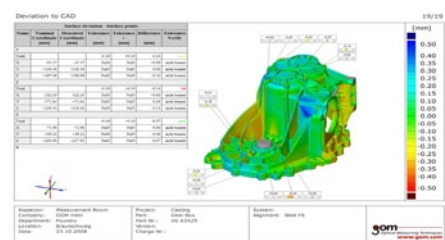


Fig. 5: ATOS Inspection Software: Typical measuring report

GOM Touch Probe

For evaluation of optically hidden surfaces such as water jackets, cooling holes, deep pockets and deep cylinders parts had to be measured until now on classical CMMs, a process which is very time-consuming due to necessary fixing and alignment of the parts.

The GOM Touch Probe as an add-on to the ATOS 3D Digitizer helps to overcome this obstacle. The handheld Touch Probe enables the user to switch easily between 3D full-field measurement and online tactile probing of specific single points (Fig. 6). A time-consuming modification or rebuild of the sensor setup is not necessary. The GOM touch probe is a calibrated set of point markers which are optically tracked by the ATOS 3D Digitizing system measuring the online 3D coordinate of the calibrated probe tip (Fig. 7).



Fig. 6: ATOS System with GOM Touch Probe

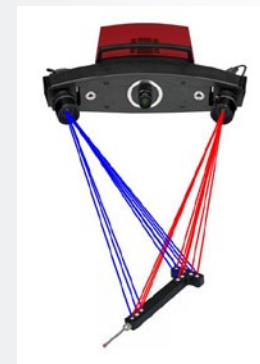


Fig. 7: ATOS sensor head as optical tracker for point markers of Touch Probe

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Thus a comfortable live inspection of points and primitives is now available. Tactile probing of geometries such as planes, spheres, cylinders and cones as well as circular, slotted and rectangular holes and borderline segments is now possible (Fig. 8, 9). The Touch Probe furthermore allows fast point based probing against CAD to determine deviations to reference data also in difficult to access areas (Fig. 10, 11).



Fig. 8: Touch Probing of deep cylinder

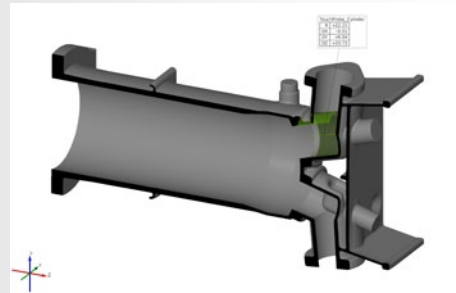


Fig. 9: ATOS Inspection Software: Touch probed Cylinder

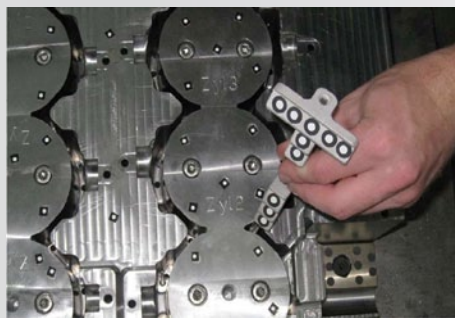


Fig. 10: Touch Probing against CAD of a water-jacket

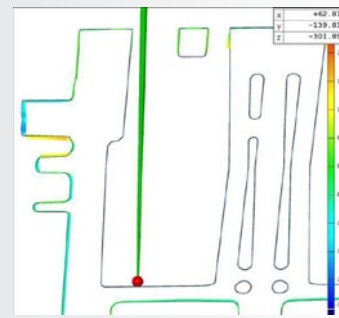


Fig. 11: ATOS Inspection Software: Online View of Probing against CAD

The lightweight Touch Probe allows effortless measurement over long periods and for larger measuring projects. A constant rigid mounting of the part such as on CMMs is not necessary. Due to the dynamic referencing either part or sensor can be freely moved to find comfortable positions. The ATOS Software allows various alignment strategies at any time. The mechanical and cable-free probe can be operated via a remote control providing high stability and unrestricted reach. An audio-feedback signals probed points and elements guaranteeing a safe workflow.

Different touch probe sizes are available for small to large objects (Fig. 12). The modular concept of the GOM Touch Probe allows an easy adaption for many different applications via fast interchange of probe heads and extenders (Fig. 13). In addition the user can create customized touch probes for specific tasks. Using the GOM Touch Probe is a fast and straight forward measurement process since all measurements are done within one system and all evaluations (surface and tactile) are accomplished direct within the ATOS Measuring and Inspection Software.



Fig. 12: Different sizes of Touch Probe



Fig. 13: Touch Probe for smaller Measuring Volume

Conclusion

Many complex metrology applications require the combination of full-field and point based 3D measurement. The GOM Touch Probe is available as an Add-On to the ATOS 3D Digitizer, combining full-field optical surface measurement and online tactile probing within one system.

The easy interchange between surface and single point measurement allows smart measuring of optical hidden surfaces and offers advantages for quick analysis of individual points and primitives as well as online comparison of individual points to CAD. ATOS and the GOM Touch probe can be also utilized to speed up alignment and calibration of parts, fixtures, jigs and gauges.