



COMPOSITE MATERIAL PRODUCTS

HOW OPTICAL METROLOGY IMPROVES
THE PRODUCTION PROCESS AT EVERY STEP



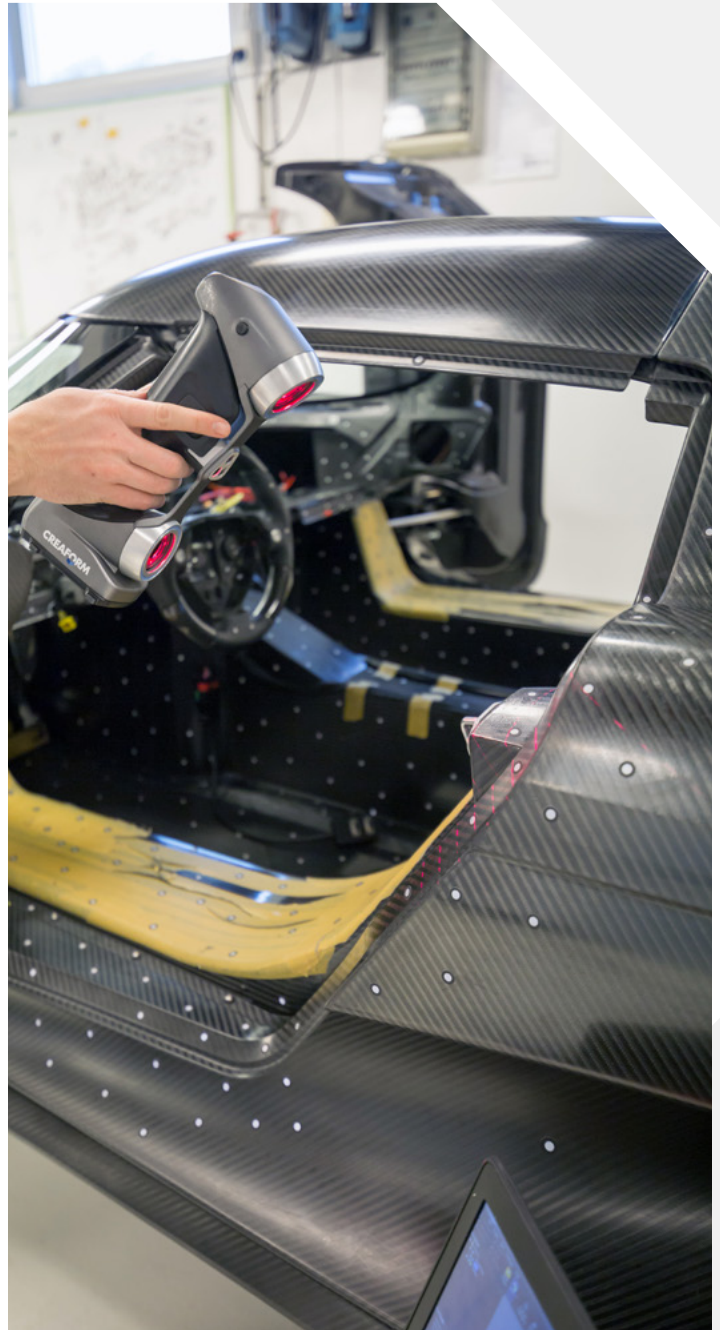
Composite materials are becoming increasingly popular in the automotive industry due to their lightweight properties. Developing new composite material products quickly and efficiently is, therefore, the main objective of the manufacturing companies working in these industries. Several problems can,

however, impact the production of composite material pieces that, once completed, will not meet the customer's requirements. Portable metrology solutions—and, more specifically, optical portable CMMs—help resolve the problems and challenges of composite material manufacturing.

CHALLENGES

The automotive industry is facing increasing pressure to meet higher fuel efficiency and better environmental performance; thus, the demand for composite materials is growing. The production of composites, however, is a complex process that requires many distinct steps.

Each step can present issues with shrinkage, part thickness, distortion, and tooling quality, which increase the pressure placed on quality control teams and their coordinate measuring machines (CMMs). Indeed, an extensive use of CMMs regularly provokes a lot of back and forth at the beginning of the production, causing a bottleneck effect, which clogs the manufacturing process. In addition, since the manufacturing of composites comprises many steps, it is not easy to locate where specific issues occur. Therefore, it means coming back and making changes until the composite material part meets the customer's requirements, specifications, and tolerances. This can result in major difficulties to pass the first article inspection (FAI) or the production part approval process (PPAP) due to measuring equipment incapability and errors that are time consuming, cause unexpected costs, induce delays, and affect customer satisfaction.



CHALLENGES
SOLUTIONS
RESULTS

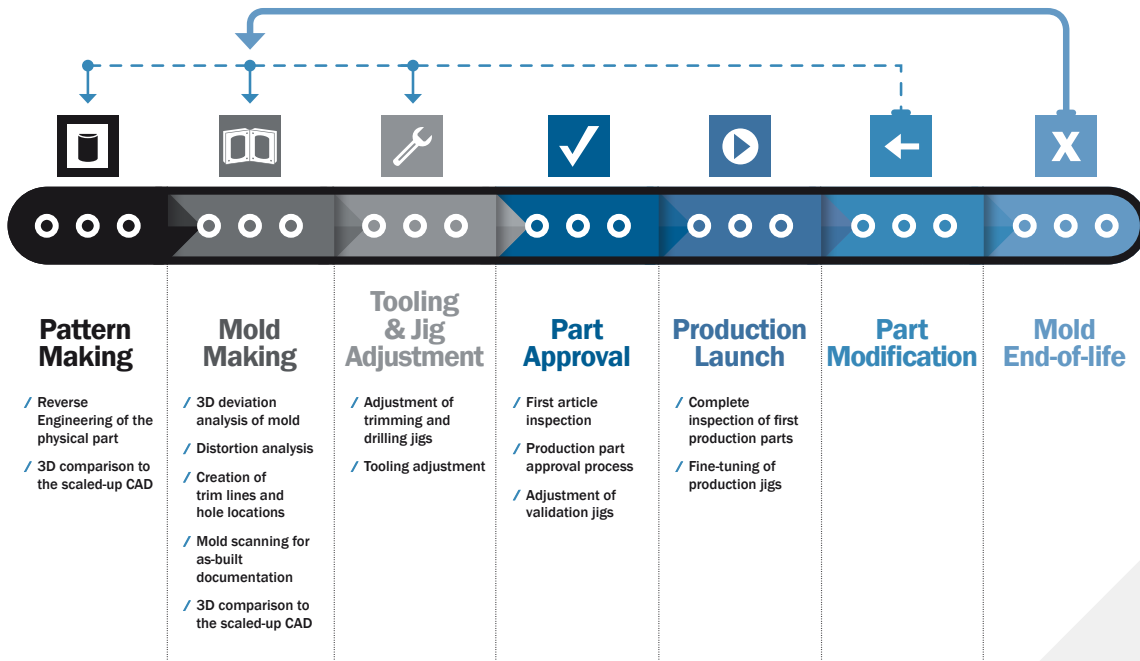
SOLUTIONS

Metrology is the best way to ensure the quality of composite materials. Among the most common metrology instruments is the CMM. Traditional CMMs, which are fixed to the ground and usually slow, require bringing the measured piece to the measuring tool. In an industrial environment, where the composite material parts are often large and cannot be moved easily, this measurement system is definitely not the fastest (in terms of programming and operating times), nor the most convenient (in terms of level of accuracy that is overkill for tolerances typically required in the industry). Therefore, metrology equipment that enables quality inspection directly on the shop floor is preferable.

Portable CMMs, such as articulated arms, laser trackers, and optical CMMs, allow this type of 3D measurement. Because of their ease of implementation and their speed, portable CMMs enable more measurements at more intermediate stages for a better quality inspection.

All these measurement opportunities, however, must be performed on the shop floor. And, shop floor measurements are often synonymous with environmental instability and by the complexity to create a rigid measurement setup, which practically eliminates the possibility to use arm CMMs and laser trackers. If a measured piece moves, vibrates, or oscillates during the measurement, then 3D inspection and quality testing will not be valid.

Optical portable CMMs can solve the specific challenges of composite material manufacturing. In fact, it is the only category of 3D measurement systems that can answer the specific needs of quality inspection in a real industrial environment. In addition to being portable, optical metrology provides measurement accuracy that is insensitive to the instabilities of the environment. Therefore, the measurement setup does not have to be rigid and the measurement volume can be wider than with standard portable CMMs and even be extended during the measurement.



SOLUTIONS

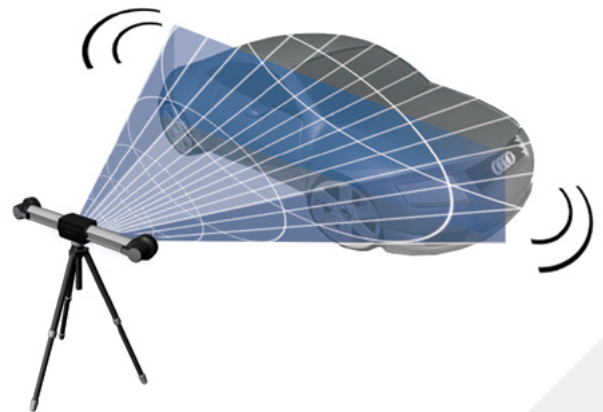
COMBINATION OF CONTACT AND NON-CONTACT MEASUREMENTS

A portable CMM can easily integrate both probing (contact measurements) and 3D scanning (non-contact measurements). Thus, benefits can be found from the ease and speed of probing when only specific measurements—fixture adjustments, critical features inspection, etc.—are needed and, at the same time, from the amount of data that can generate a 3D scanner when a complete part inspection—FAI, PPAP, distortion analysis, etc.—is required.



DYNAMIC REFERENCING

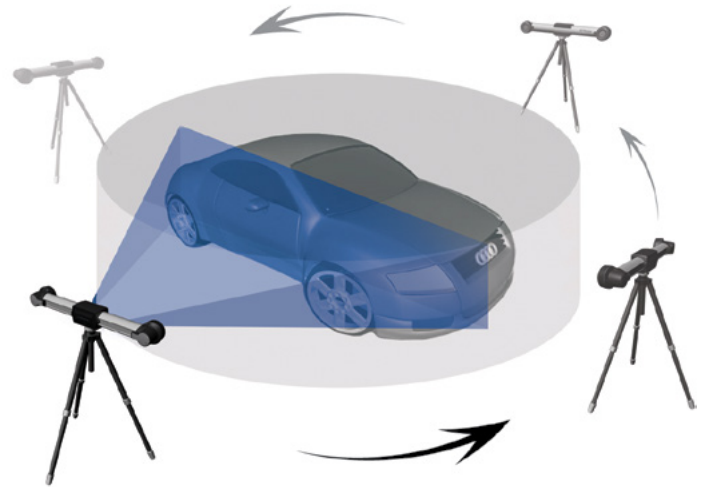
Vibrations are common on a production floor. They can come from nearby road and rail traffic, production and handling equipment, or operator manipulations. Since quality control equipment is accurate at the micron scale, these vibrations will impact the measurement system unless an optical CMM is used. The optical technology, made of an optical tracker and reflectors, delivers dynamic referencing by optically tracking the measured part and the measuring device at the same time. Optical reflectors are used to create a reference system that is locked to the part itself, so the object can move during the probing and scanning sessions. Thus, the measuring system provides that same level of accuracy regardless of the environmental instabilities, user experience level, and setup rigidity.



SOLUTIONS

EXTENDABLE MEASUREMENT VOLUME

While traditional CMMs have a measurement area mechanically limited to their work table, articulated arms have definite measurement volume limited to the maximum attainable point. Optical portable CMMs, however, provide an extendable measurement volume that does not require additional alignments or manipulations. As long as the optical tracker sees its targets, the measurement system can be moved. In a context where composite material often means large parts that must often be moved around, having a flexible measurement volume that can be easily and dynamically extended without loss in accuracy or conventional leapfrogs is an important feature for the operators. Finally, a wireless measuring probe that can be freely manipulated by the operators, without any physical attachment to a poly-articulated arm, tripod or fixture is another feature facilitating the quality control at each step of the production process.



RESULTS

Optical metrology, therefore, is intended to simplify the measurement and quality inspection of composite material parts. At each stage of the production process, this portable technology enables more reliable and efficient measurements, and better quality controls. Since it enables measuring the parts directly on the production floor without a limited measurement volume, less alignments and manipulations are required leading to less error accumulation, less pressure on quality control operators, fewer bottlenecks at the CMM, and therefore, more efficient production processes.

Optical metrology gives to the manufacturers the possibility to supply more complete and documented inspection reports that facilitate and accelerate the customer's verification and approbation. Moreover, using optical portable CMMs avoids workload bottlenecks on traditional measuring equipment as fixed CMMs can be allocated to specific highly accurate measurements.

Because optical portable CMMs address the specific needs of composite material manufacturing, they improve the production process at every step and enable the development of better composite material products, more efficiently, and more quickly.



ABOUT THE AUTHOR

Creaform empowers customers with adaptable 3D measurement tools to help them improve their manufacturing processes and overall workflow. From product development and design to quality control on and off production lines, Creaform develops high quality industrial optical metrology devices and software that enhance clients' turnaround times and profitability.

Creaform is part of AMETEK Ultra Precision Technologies, a division of AMETEK Inc., a leading global manufacturer of electronic instruments and electromechanical devices.

For more information about portable 3D measurement solutions for your specific quality control application, visit the Creaform website.



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Creaform

CHALLENGES
SOLUTIONS
RESULTS

HIGHLIGHTS

CHALLENGES

- Too much back and forth causes bottlenecks at CMMs
- Large dimensions of the measured pieces
- Instabilities induced by the environment
- Difficulty measuring directly on the production floor
- Continuous re-alignment

SOLUTIONS

- More opportunities for inspection
- Easy combination of probing and 3D scanning
- Dynamic referencing capability
- Extendable measurement volume
- Wireless measuring device

RESULTS

- More reliable measurements
- Better quality control
- Less pressure on quality control teams and equipment
- Better use of traditional CMMs
- More complete and documented inspection reports
- Quicker approval time (FAI, PPAP)
- Faster payment
- More efficient production process
- Better quality of composite materials

Contact us or visit our product pages on our website.
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