

GEOMETRY ASSURANCE FOR WIND TURBINE BLADE PRODUCTION

Metronor Application Note

Background

In the quest for renewable energy, wind turbines play an important role. Efficiently generating energy from the wind requires advanced aerodynamic shapes and highly accurate airfoils. In fact, even the smallest deviation in wind turbine blade profile can cost the operator thousands in lost energy revenue.

One requirement for building quality blades is the need to control the complete production process all the way from blade design, plug and mould development, layup of materials, moulding, finishing, through inspection of the finished blade surface.

Metronor has developed a series of products that are designed to assist in securing the geometry through all these process stages. Not only will a systematic approach to geometry assurance result in a high quality product for the end customer, but also minimize scrap and necessary rework during the blade manufacturing process.



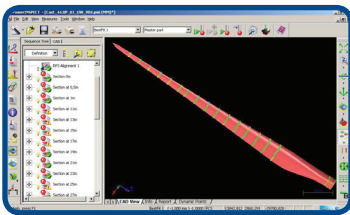
Solution



Based on Metronor's patented principle allowing accurate 3D measurement with just one single video camera and a hand-held probe, SOLO is a uniquely portable and affordable coordinate measurement system offering full CMM capability including comparison of just about any geometry to CAD data or blueprint.

Ideally suited where fast setup, ease of use and high portability is critical, SOLO offers a superior working volume and can be operated through a wireless connection - without cumbersome arms to balance or cables to untangle.

The Metronor SOLO is delivered as a turnkey solution for the blade manufacturer. In addition to hardware and software the delivery includes installation, training, procedure development and comprehensive technical support packages.



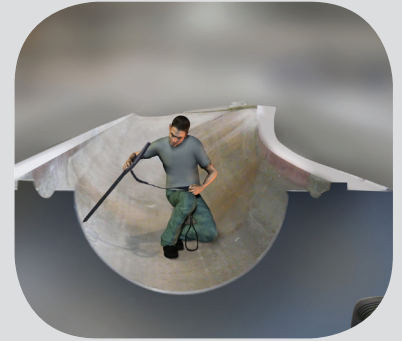
Metronor PowerINSPECT, the Application software, can be tailored to the needs of each individual customer. The graphical user interface is based upon a measurement plan that can incorporate detailed operator instructions in the form of text, pictures and video.



MOULD AND PLUG MEASUREMENTS

The system is ideally suited for geometry verification of plugs and moulds. Online comparison can be done between actual shape and nominal shape as per the design CAD model. Applications include both certification of plug and mould geometry, in addition to scheduled verification and maintenance checks.

The probing capability of the Metronor SOLO allows for a large number of measurement points to be captured in a short time. The real time geometry analysis gives the necessary correlation between blade and mould geometry to predict scheduled or “on event” mould maintenance needs.



BLADE ROOT MEASUREMENTS

The tolerances of the interface area towards the wind turbine hub (blade root) needs to be controlled carefully in order to ensure both trouble free assembly and operation of a wind turbine. There are two critical characteristics of interest:

- Root flatness
- Root hole pattern geometry such as ovality and bolt hole center location

Both of these characteristics are measured with extreme accuracy using a SOLO system. Optimizing measurement setups utilizes the unbeatable 2.5D accuracy of the SOLO to comply with even the toughest requirements for blades of every size.



BLADE GEOMETRY MEASUREMENTS

The efficiency and durability of a wind turbine is heavily dependent on the shape of the outer blade surface. Blade surface shape can be compared directly to the design CAD model in real time, or more simplified checks such as distances and thicknesses can be inspected without the need for CAD data. Typical characteristics to inspect include:

- Blade profile
- Blade thickness
- Trailing edge thickness
- Leading-to-trailing-edge length
- Section twist relative root hole pattern (“alpha angle”)



Benefits

Customer benefits of implementing the Metronor technology are innumerable. The straightforward short-term benefit is the ability to deliver blades with certified traceable geometry to the end customer. In today's ever increasing strive for quality, geometry assurance of products plays an important role.

Longer-term benefits include the ability to study all parts of the production process in order to identify and correct weak points or bottlenecks. The ability to benchmark various production lines or factories is important in order to make sure blade geometries are identical, irrespective of production line or production factory.



SOLO SYSTEM

- Complete and truly portable: One box, 24kg, for complete system including computer and tripod
- Extended probing capabilities including hidden features (450mm plus probe length)
- Operator friendly: Probing without beams, wires or arms
- Fast and easy set-up and use
- No warm-up, initialization or leap-frogging
- No moving parts eliminate re-calibration
- Can be upgraded to DUO and DUET system
- Price/performance winner
- Designed for use in rough production environments

ABOUT METRONOR AS

Metronor is a privately held ISO9001:2008 certified high technology company headquartered outside Oslo, Norway. Metronor has developed a range of high accuracy, large volume, portable electro-optical coordinate measuring systems that provide excellent return on investment for our customers as well as facilitate a highly efficient dimensional management of their manufacturing processes.

Metronor's Industrial Systems Business Unit provides a range of measuring systems to a variety of industries worldwide, either through trusted partners or directly through offices in the US, Germany and China. The flexible and robust nature of the systems enables them to be applied to a multitude of different applications within automotive, casting and machining, mold and die, energy and other transport and heavy industries. The systems are considered especially valuable when used for large measurement volumes, to optimize processes and in challenging environments.

Metronor's Military Systems Business Unit provides a custom MIL-STD 3D and 6D boresighting system and solution. The product line includes systems for boresighting/harmonization of various airborne and ground based weapon system platforms. HarmoLign also allow for full alignment/harmonization of Helmet Mounted Display and Sight tracker systems, making it a complete solution for the Military industry.

More information at www.metronor.com and www.harmolign.com

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