LASER GAUGE® APPLICATION

Leading Edge Profile

Inspection Problem

The leading edge of a vane or blade used in aircraft or power system engines must maintain its designed contour within an acceptable range for safe and efficient operation of the engine. Measurements that are critical include the edge radius and the width or thickness of the blade at varying distances away from the edge.

Previously, the only reliable method of inspecting the blade was to use a coordinate measurement machine (CMM). However, this process is very time-consuming and requires each part to be transported to a central location for inspection.

Requirements

Measurements - The leading edge radius must be accurately measured to within 0.001" and the width must be measured to within 0.0005" to determine if the contour still falls within the tolerance range.

Instrument - Blades are inspected before they are put into service. They are also inspected during regular repair cycles. It is important to be able to use the inspection instrument at different locations in the production facility and at different stations in the repair center.

LaserGauge® Solution

LaserGauge System - A custom sensor was adapted with cross-vector capability to simultaneously capture surface data around the leading edge and on both sides of the blade. The hand-held sensor, Model HS330LE-F02, has a 0.125" FOV and an integrated positioning encoder that provides a third dimension to the surface data. The encoder gives the location along the blade where the scan was made.

For this application, a laptop computer and a PCMCIA interface card handle the data processing and user-interface requirements. Any Windows™ 2000 or XP computer with a PCMCIA slot can be used as the processor; a portable LaserGauge® controller is not used for this application.

Operation - The sensor is positioned on the blade at a starting point and the encoder zeroed at that point. Scans can be taken singularly, each with a trigger pull, or continuously as the sensor is

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moved along the leading edge. The raw scan of both sides of the blade is shown in the display, and the combined plotted profile of the blade is shown as well.

Measurements - Made automatically as the operator scans the blade, measurements include:
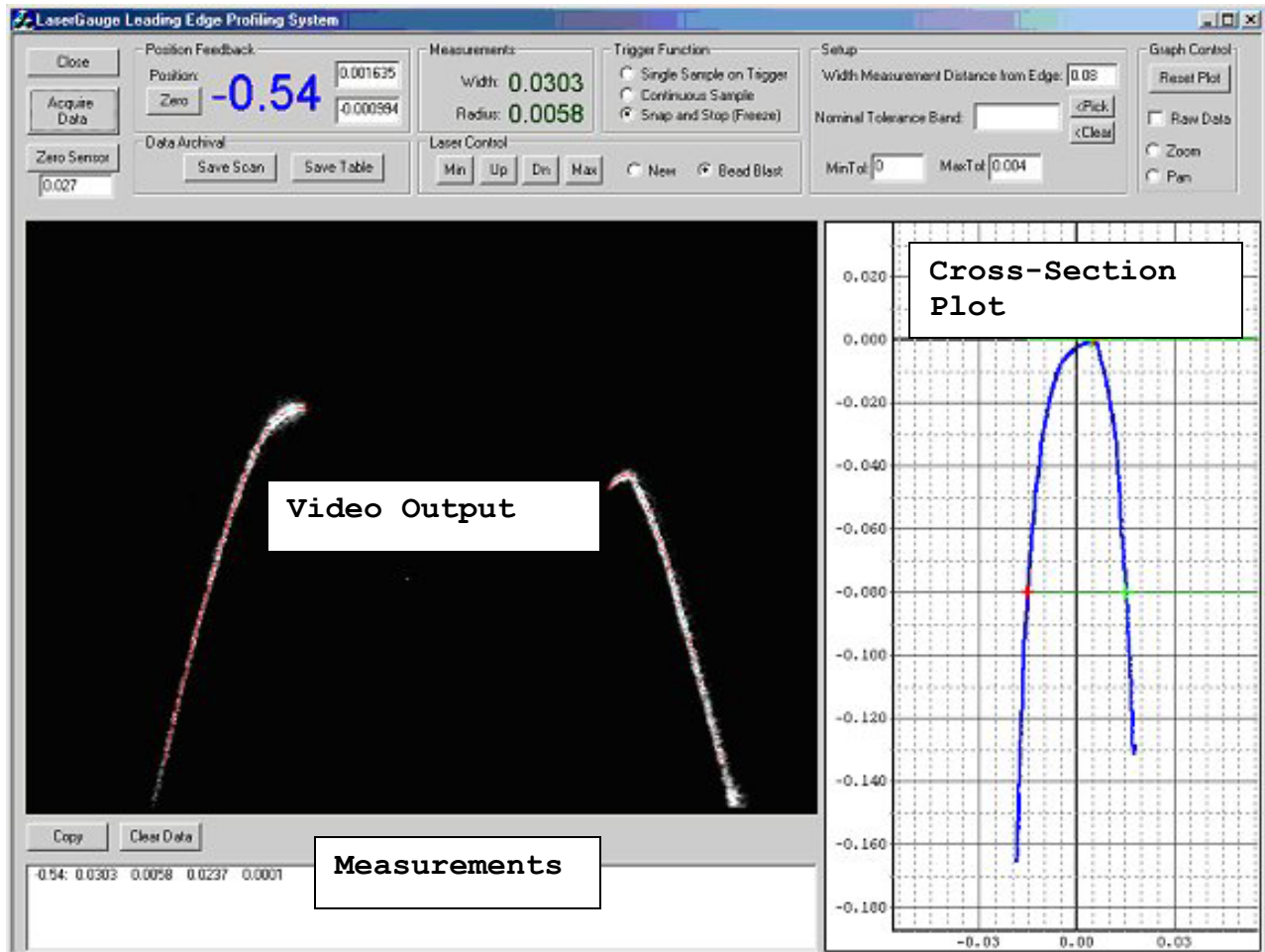Position - the position along the blade, relative to position zero.
Width - the thickness of the blade at the selected offset distance from the leading edge.
Radius - the calculated radius of curvature of the blade.
Radius_maxerror - the maximum error of the radius fit.
Radius_error - the average error of the radius fit.

Documentation - Data displayed in the table can be saved as documentation of the measurements. A scan or profile can also be saved to a file. The file is a flat tabular file with x,y,z coordinates of each point in the scan; the x value representing the position along the blade.

CAUTION
LASER RADIATION -
DO NOT STARE INTO BEAM