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Sceptre Application Notes
Aircraft and Power Generation Industry

Sceptre 3.0 has been enhanced with a variety of specialized analysis and reporting features that simplify the analysis and make possible complex measurement tasks on a variety of turbine blades. Along with a tutorial "Air Foil" macro library users can now perform these example evaluations and reports. These macro's can then be tailored into the users need's.

You will find enclosed actual reports that Sceptre is now capable of generating on airfoil type parts. An AIRFOIL element evaluates the most frequently inspected features of an air foil or turbine blade type of component. Simply feed this routine a scan data set of a sequential set of points on a cross section and the analysis will Report.

- **Chord Length** The max length between the leading and trailing edge.
- **Pitch Diameter** The max width across the blade body.
- **Leading Edge Thickness** At a given depth from the leading edge the thickness of the blade
- **Leading Edge Radius** Calculate the actual radius of the leading edge
- **Trailing Edge Thickness** At a given depth from the trailing edge the thickness of the blade
- **Trailing Edge Radius** Calculate the actual radius of the trailing edge
- **Pressure Angle** Calculate Functional Line at which pressure side will rest against a flat surface

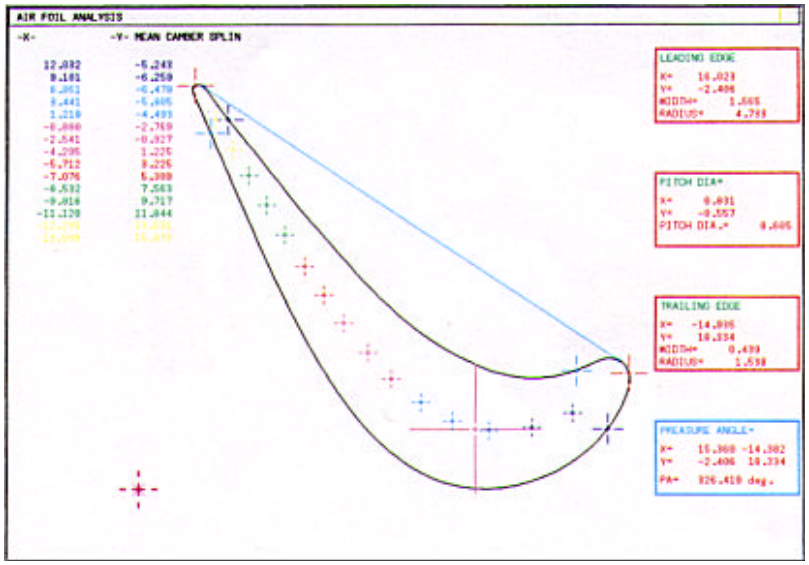
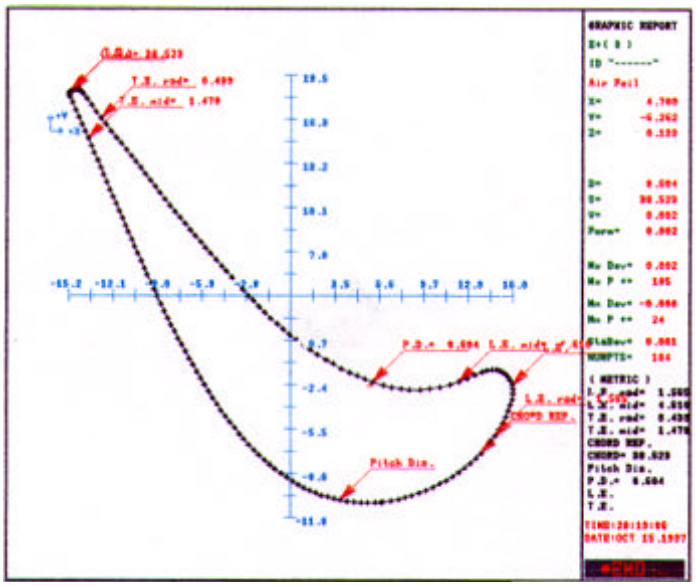


Figure 1 - Screen display after Air Foil analysis in which the Mean Camber spline and the standard Airfoil outputs are displayed.

Data From a scanned cross section at 8mm/sec, using 5.0 mm probe tip.

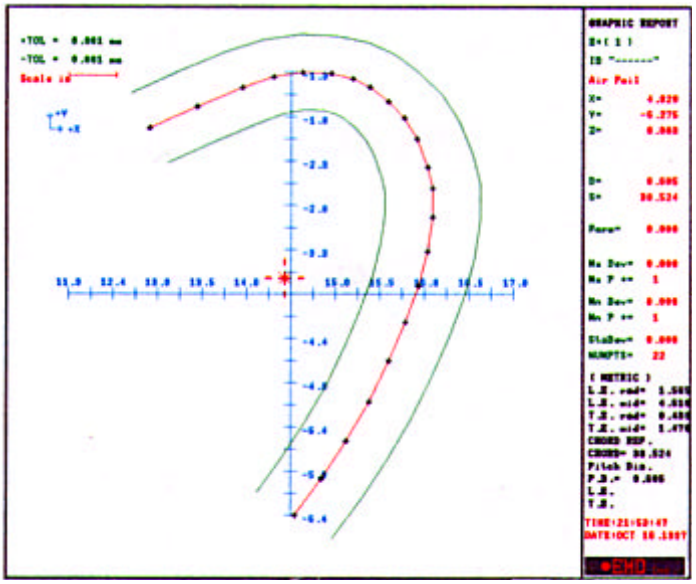
Figure 2- Graphic display of air foil analysis with displayed marker points.

Not only can you report the numeric dimension but it can set graphic marker points that permits the system to pictorially show you where the airfoil element decided to make these measurements.



In addition to performing these airfoil analysis it, can cut out a subset of data from the full data set based On the function. The programmer may select to analyze, plot or process , in some manner, the leading edge, trailing edge, pressure side and suction side separately.

Figure 3- Graphic display of a subset of the data in Figure 2. The Leading edge points have been isolated and displayed.



Compare

In an established reference system , based on common datum system from a blue print, the Compare command will mathematically compare the Actual data measured to a nominal blade section. With this mathematical model of points and variation, it is now possible to blow up the variation between the two. On a single Piece of 8 1/2 x 11-inch paper we can portray micro inches of variation by the use of a deviation scaling factor.

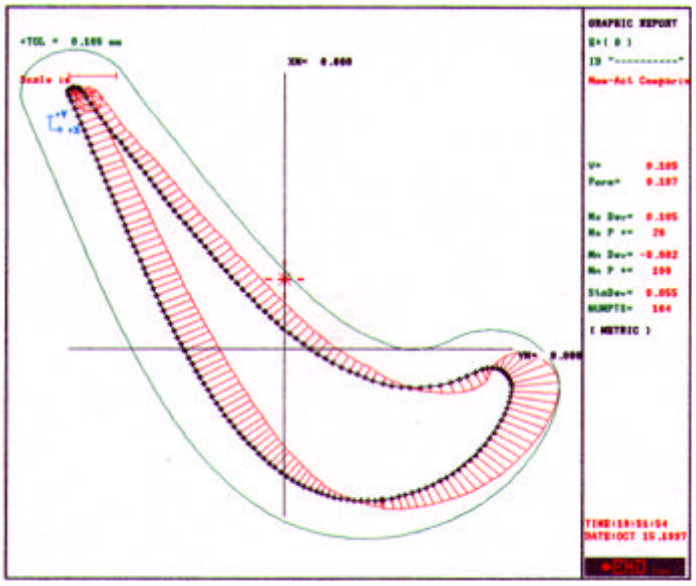


Figure 4- Graphic display of a comparison between a nominal air foil section and an actual air foil section.

Nominal - black cross marks
+Tolerance - Green Line
(.1mm scaling factor)
Deviation - Red Line and Spike
uses same scaling
Factor

Note: Variation indicates location of airfoil is off.

Best Fit

After comparing them go ahead and best fit them together. The system will then determine the combination of shifts, and rotations so that the variations become a minimum.

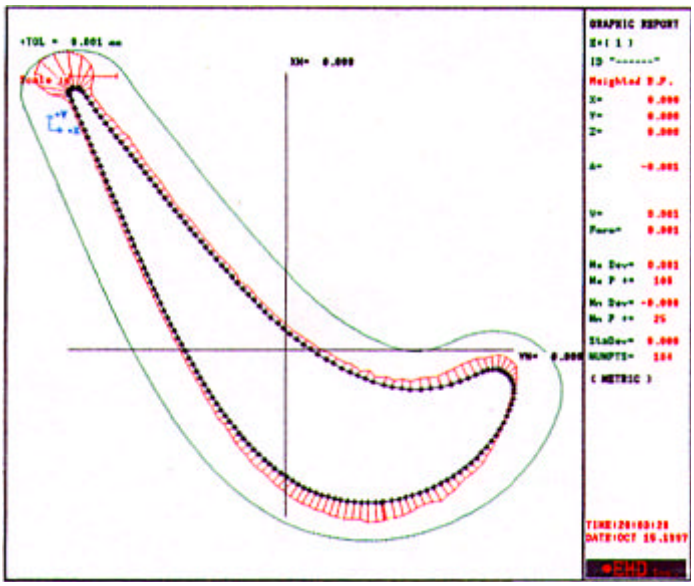


Figure 5- Graphic display of data in Fig.4 after a best fit. Note: The scaling factor is now smaller. The variation has been reduced thus we can magnify the variation more.

Nominal - black cross marks
+Tolerance – Green Line
(.01mm scaling factor)
Deviation - Red Line and Spike
uses same scaling factor

Note: Variation is now symmetrical and thus blade location has been Corrected.

Figure 6- Graphic display of data in Fig.5 after entering point editor and marking points. See arrows marking point on leading pressure side of foil.

This simulates inspectors with overlay charts having a selective preference for doing “best fitting” based on human interaction.

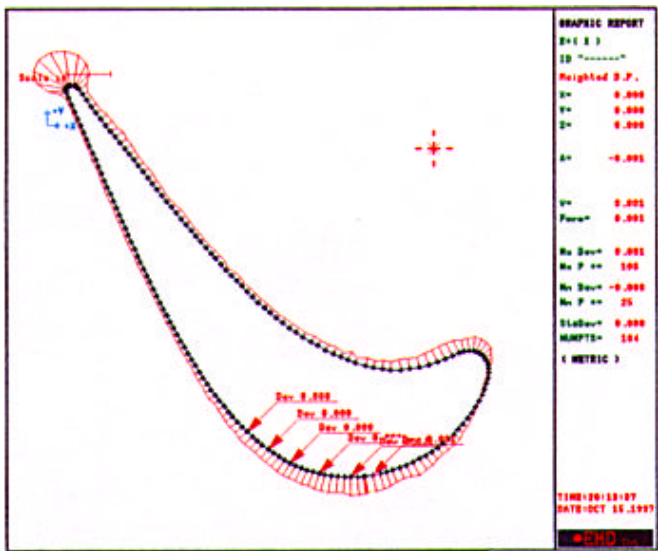


Figure 7- Graphic display of data in Fig.6 after best fitting utilizing weighted marker points. Note: That at the selected Marker point the variation has been reduced. the remaining points that were not selected have had their variation increased.

A prominent foil best-fit philosophy is based on taking some points near a selected zone at the leading and trailing edges on both foil surfaces.

Sceptre also allows the user to do several best fits and combinations of them, which allow for the determination of bow and twist in 3D.

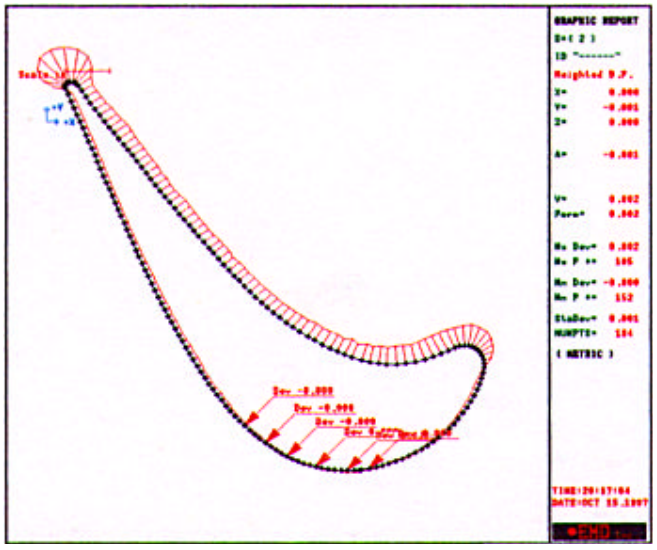


Figure 8- Screen display during MANFIT Manual Fit editor screen. In this mode Screen display shows Nominal and actual Data as the operator shifts and rotates data to each other via mouse and cursor moves.