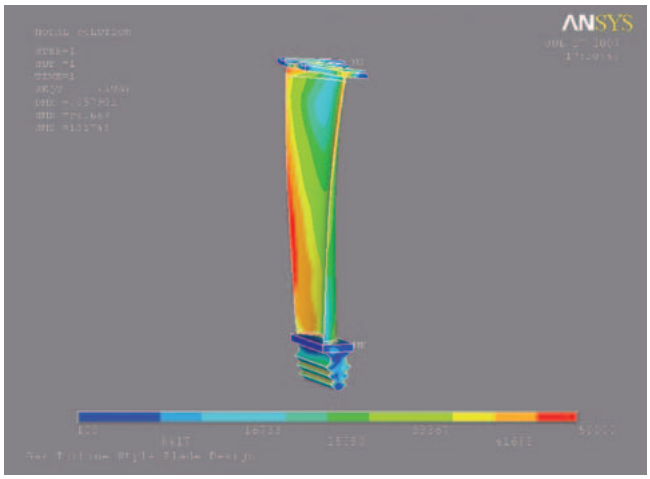
Turbomachinery: BladePro-AF and BladePro-CF make a Strong Partnership with ANSYS

For turbomachinery design the analysis of steady and dynamic stresses, and dynamic characteristics are critical. Two products of Impact Technologies, LLC, Rochester, NY, USA, complement here the capabilities of ANSYS.

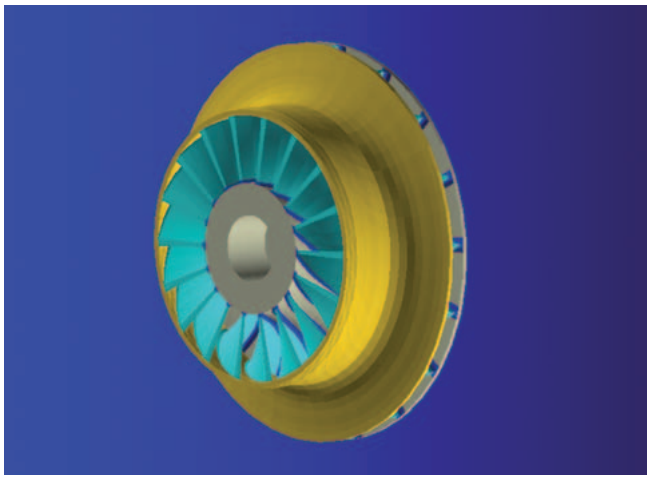
Turbomachinery components are subjected to high steady stresses from centrifugal forces and dynamic stresses from aerodynamic excitations. Care must be taken in the design to avoid resonance conditions which could lead to cyclic fatigue and premature failure. Impact Technologies, LLC has developed BladePro-AF™, for the analysis of axial flow blading, and BladePro-CF™, for the analysis of centrifugal, or radial, flow impellers. Both these software packages run with ANSYS to assist the turbomachinery design engineer with these important analyses.

To begin, an engineer takes basic geometry data and feeds it into either BladePro-AF or BladePro-CF to form a 3D ANSYS model.



Using the rotational speed and aerodynamic loading ANSYS calculates the steady stress throughout the impeller or blade. Once the steady stress analysis is complete the engineer is able to display displacements and maximum principle stresses (for crack propagation) and von Mises equivalent stresses (for crack initiation) easily with ANSYS. Next natural frequencies and mode shapes are calculated. The BladePro programs select master degrees of freedom and allow the engineer to modify these. ANSYS then calculates the natural frequencies and mode shapes at zero rpm and at the maximum operating speed. The back-substitution files are saved for subsequent harmonic forced response analysis. With turbomachinery it is important not only to look at the natural frequencies but the mode shapes as well. Diametral and circular mode shapes are critical to assess the likelihood of a dangerous resonance condition. Mode shapes are easily understood with BladePro's specialized post-processing routines.

Dynamic forced harmonic response analysis is performed to calculate dynamic stresses. Harmonic excitation can be caused by low frequency, per-rev excitation or high frequency excitation from wakes shed by upstream stationary vanes. It is important to examine a number of locations in the component because the "worst case" combination of steady and dynamic stresses is not always obvious. Here the Goodman diagram, as presented by either BladePro program, is valuable in providing a graphic display of the combinations of steady and dynamic stresses against the material allowable line. Once the critical locations are identified the engineer can use the Local Strain module of either BladePro program to calculate the time to crack initiation at any location and combine that information with the duty cycle of the machine to predict fatigue life.



The combination of BladePro-AF and BladePro-CF with ANSYS allows engineers to easily determine the response of turbomachinery and to determine its margin against fatigue damage in order to verify the integrity of their designs. Using BladePro-AF or -CF substantially cuts the time for analysis even for experienced ANSYS users.

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Impact Technologies, LLC has its headquarters in Rochester, New York in the United States and has two other locations in the U.S. The company has been in business since 1999 and has over 90 employees with over 75% holding advanced degrees. The company are specialists in equipment health management. In addition, Impact has developed and markets two software products: BladePro-AF and BladePro-CF for the structural analysis of turbomachinery.

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