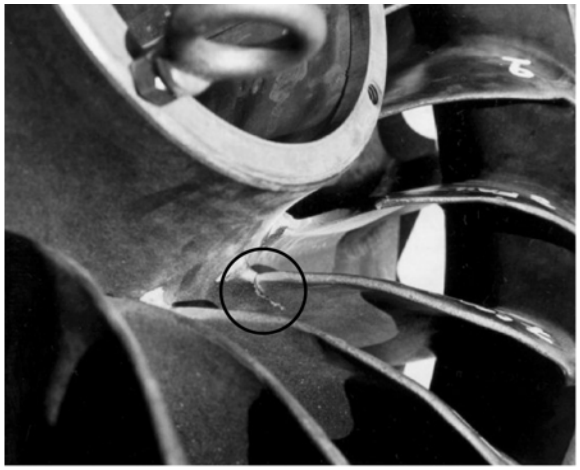
Mechanical Solutions, Inc.
Rotating Machinery Analysis, Test & Troubleshooting

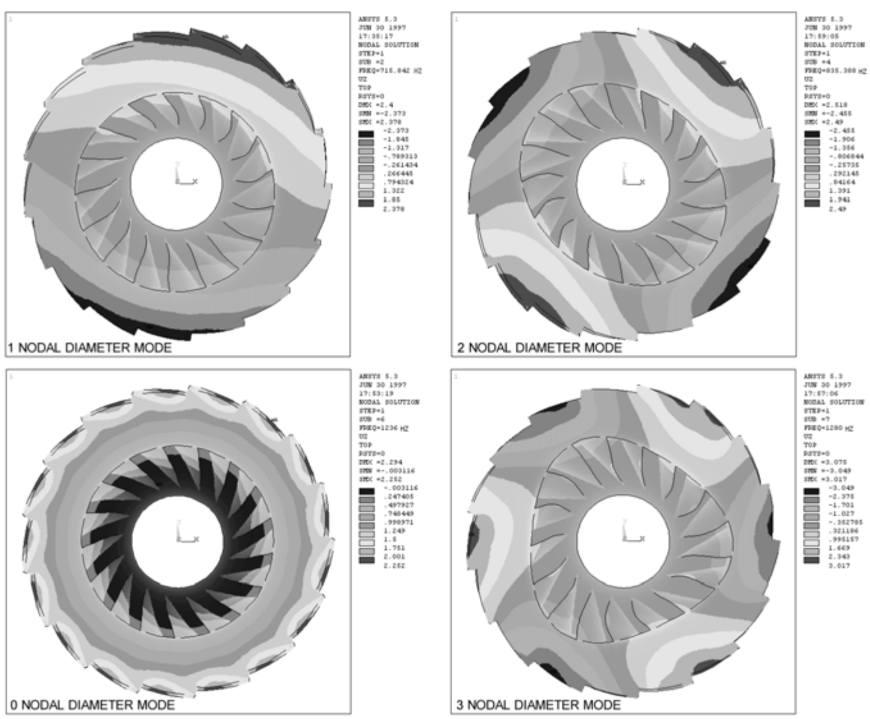
Case History: Impeller Failure Analysis



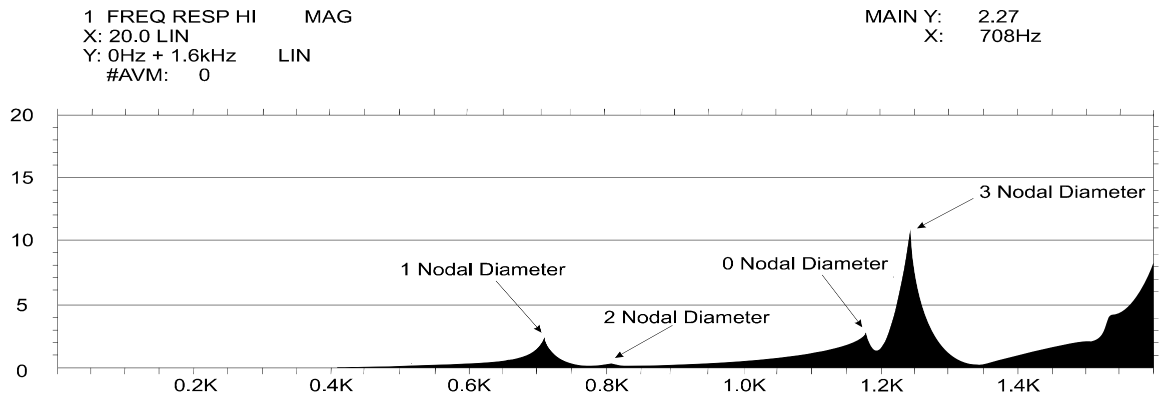
Fatigue Failure at Blade Inlet

MSI was contracted by a customer to investigate a series of blade cracking problems in a compressor impeller. An FEA model of the impeller was created to perform a natural frequency modal analysis. The model was well correlated with experimental modal analysis test results.

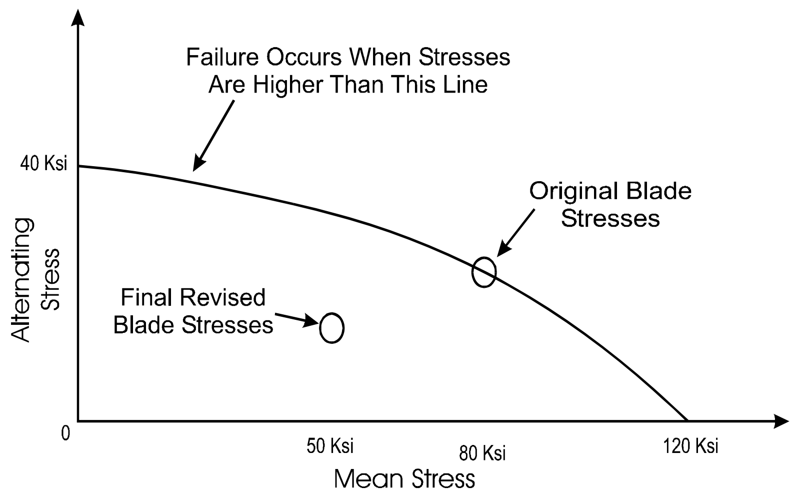
The analysis confirmed that the failure was vibration induced fatigue caused by the synchronization between the vane/ blade "sum and difference" three-lobe pressure-pulsation at blade-pass frequency and the natural frequency of the disc three nodal diameter mode. Based on the worst case loading situation occurring in service, the design was marginal, and the factor-of-safety was very close to 1.0.



Finite Element Analysis Results



Experimental Modal Analysis Test Results



Goodman Diagram Life Assessment

Several "what if" possible modifications were tried in the FEA model, and the optimal recommendation suggested by MSI was able to increase the factor-of-safety by over 50%.

The whole project was compressed into a very small time window due to the very tight overhaul schedule requirement.

MSI was able to meet the customer's needs by constructing and running the complicated model very quickly, using our powerful FEMAP and ANSYS Multi-Physics software. In addition, our unique capability to couple such analysis methods with advanced test techniques led to a solution that the customer could have confidence in.

Mechanical Solutions, Inc.
11 Apollo Drive
Whippany, NJ 07054 USA
www.mechsol.com

Tel: (973) 326-9920
Fax: (973) 326-9919
msi@mechsol.com