APPLICATION NOTE
AN1701

TRILION - APPLICATION NOTE
Vibrational Analysis using Optical Metrology

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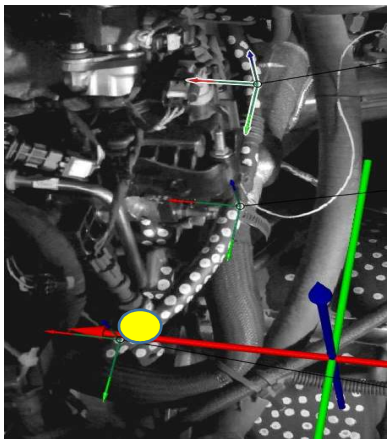
Problem overview

Identifying resonance modes of auxiliary piping systems in automotive applications is critical to ensure the system can withstand the harsh conditions of operation which can lead to fatigue failure during the lifetime of the parts in question. ARAMIS High-speed metrology techniques were employed to identify component resonances at various engine operation speeds.

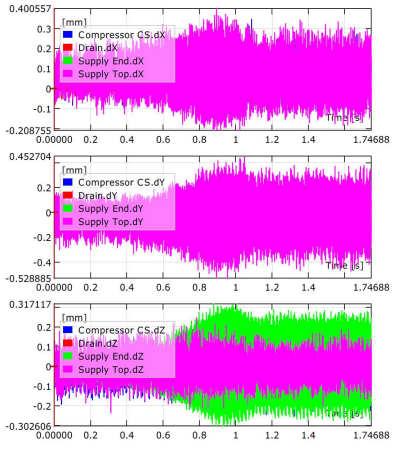
Test setup

Conventional spray paint is utilized to construct a 6 DOF trackable point constellation. The yellow dot shows acquisition point for FFT data below.

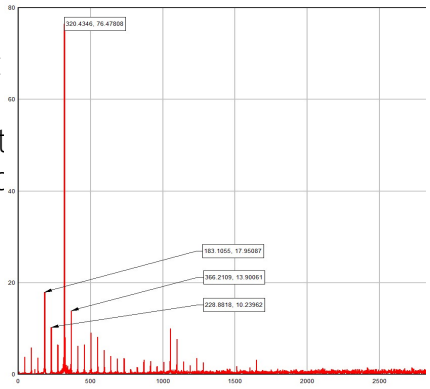


Notes

The application allowed for advanced detection of system resonance during an RPM sweep. Using ARAMIS, a constellation of points is tracked at 15kHz to highlight damaging frequencies of interest. As the system approaches its resonant frequency the amplitude of deflection increases exponentially. (**shown below**)



The ARAMIS system, including Photron AX-200 high-speed cameras (sampling at 15kHz) was used in RPM sweep resonance detection. The testing was performed on auxiliary compressor piping. Direct velocity measurement were acquirec allowing for Fast Fourier Transform analysis to highlight detrimental operating frequencies in the system. Each component in the systems constellation of points is tracked to 6 DOF showing displacements and rotations as well. The acquired data permitted for a direct FEA comparison, while even elucidating frequencies of interest not predicted in the model.



Conclusion

ARAMIS high-speed vibrational analysis was shown to be highly effective at identifying resonant frequencies of operation in an automotive component model verification.

Keywords: *Vibrational Analysis, FFT, Resonance, ARAMIS, Optical Metrology, FEA validation, 6 DOF*