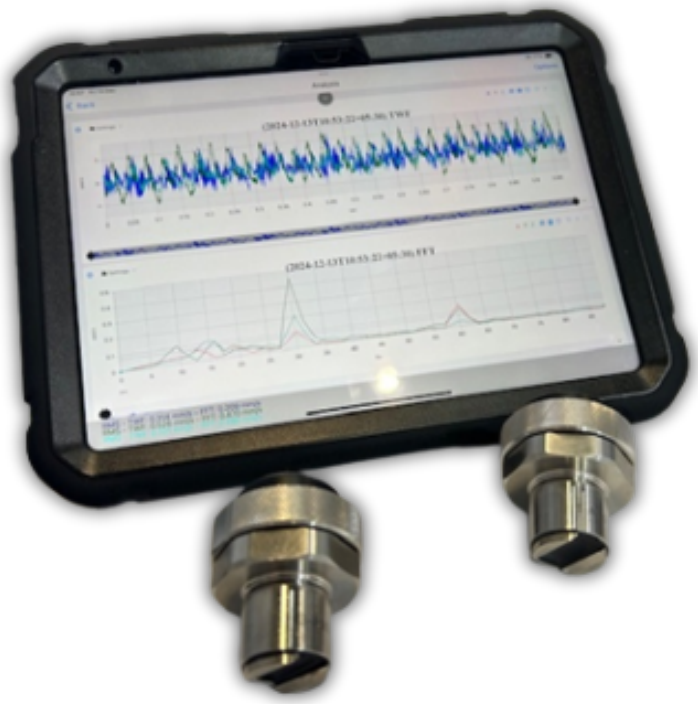
AV
INDUSTRIAL PRODUCTS

VIBRATION TESTING AND ANALYSIS FOR INDUSTRIAL APPLICATIONS



ABSTRACT

Vibration testing is an important tool for assessing the behaviour of mechanical systems, diagnosing faults, and optimising vibration isolation solutions. This paper presents an overview of Fast Fourier Transform (FFT) vibration testing and analysis techniques, as employed by AV Industrial Products Ltd, utilising multi-channel FFT analysers using both wired and wireless accelerometers. The paper discusses various applications, including evaluating anti-vibration mountings, identifying disturbing frequencies, and ensuring compliance with industry standards such as ISO 10816, ISO 7919, and ISO 2631. Additionally, the paper considers the differences in vibration characteristics between traditional engine-driven machinery and electrified equipment, such as electric vehicles (EVs) and electric motors.

01 Introduction

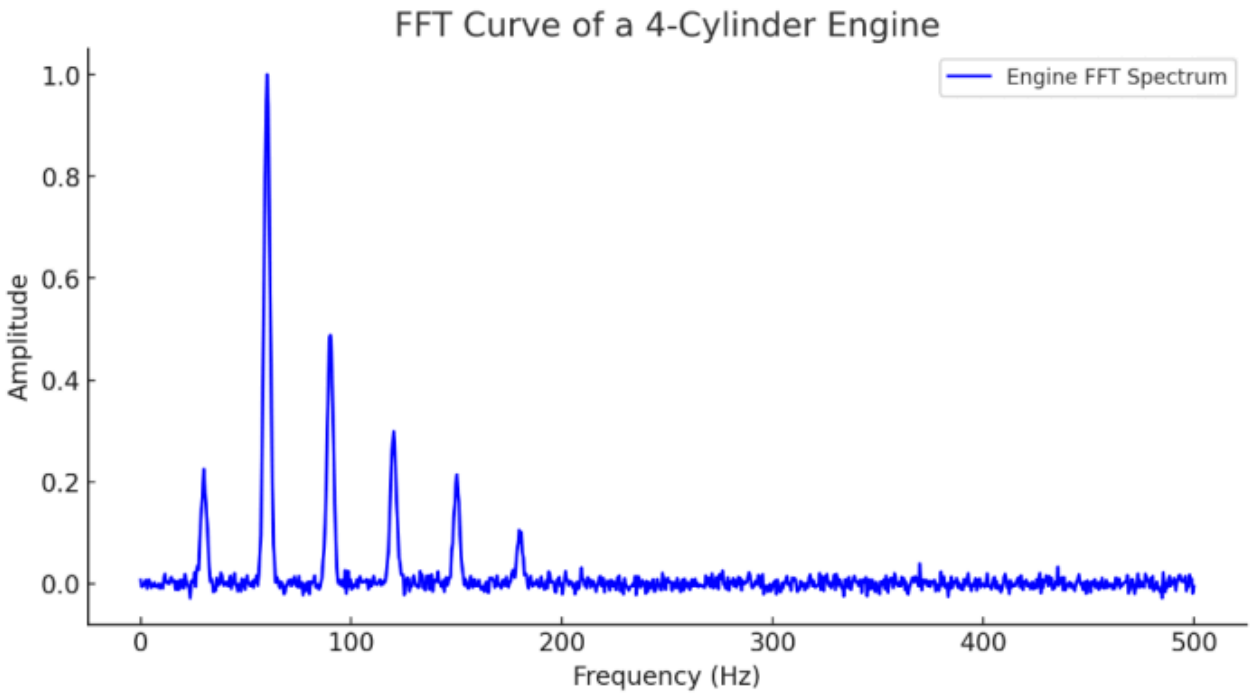
Vibration testing and analysis play a crucial role in the mechanical and industrial sectors, ensuring machine longevity, improving operational efficiency, and minimising downtime. Anti-vibration mountings are widely used in machinery such as generators, construction vehicle engines, and pumps to control and reduce vibration and it effects. Understanding the principles of vibration isolation engineering and material properties of elastomers is essential for optimising system performance. The shift towards electrification in industrial and automotive applications presents different vibration characteristics compared to internal combustion engine-driven machinery, requiring a refined approach to vibration analysis.

02 Methodology

2.1 Fast Fourier Transform (FFT) Analysis

FFT analysis is a mathematical technique used to transform time-domain vibration signals into the frequency domain. This allows engineers to analyse the vibrational characteristics of mechanical systems by decomposing complex vibration signals into their constituent frequencies.

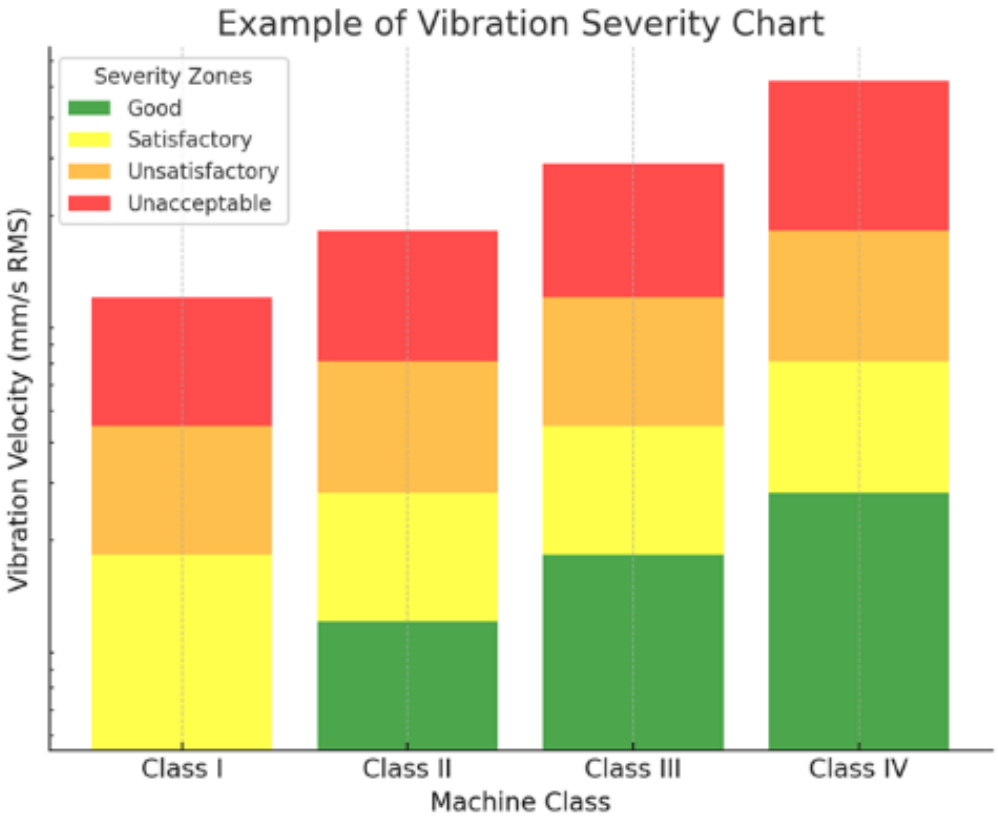
The FFT is an optimised computational algorithm that efficiently computes the Discrete Fourier Transform (DFT), making real-time signal analysis feasible for vibration monitoring applications. By applying FFT to vibration signals captured by accelerometers, engineers can determine dominant frequencies, identify resonances, and detect anomalies such as misalignment, unbalance, and bearing defects.



2.2 ISO Standards for Vibration Measurement and Analysis

International standards provide guidelines for evaluating machine and vehicle vibration, ensuring safety, and maintaining operational efficiency. The most relevant standards in vibration analysis include:

ISO 10816 – Mechanical Vibration – Evaluation of Machine Vibration by Measurements on Non-Rotating Parts: This standard defines vibration limits for different types of rotating machinery, classifying machines based on power rating and foundation type. It provides vibration severity charts and recommends limits for acceptance testing and condition monitoring of industrial machines.

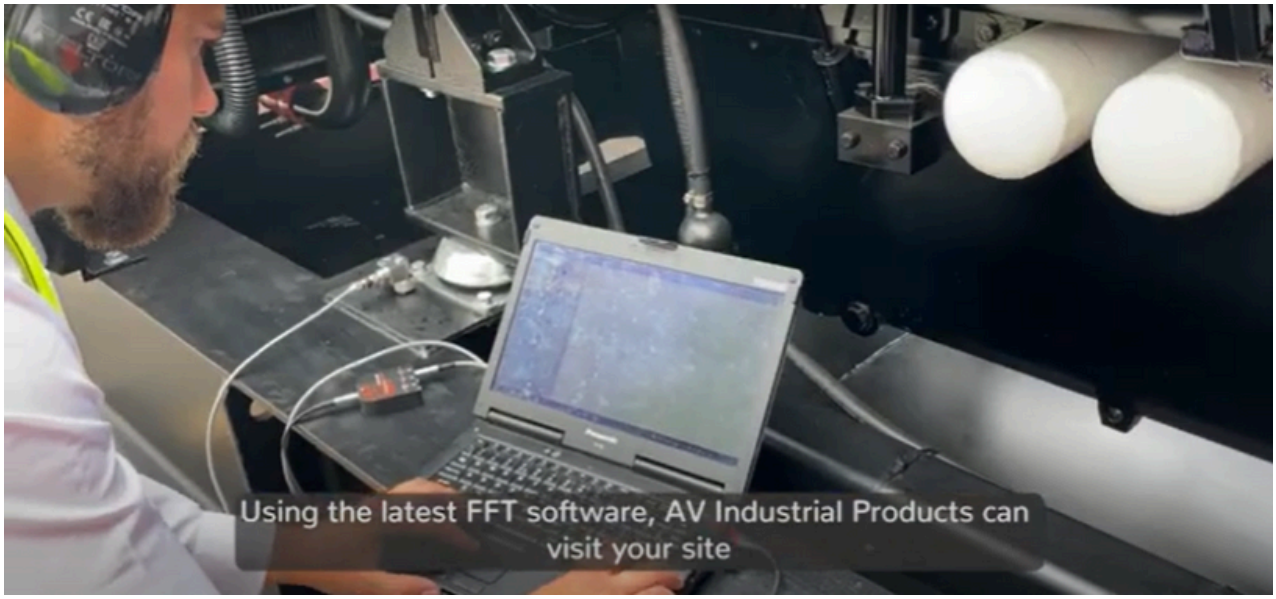


ISO 7919 – Mechanical Vibration – Evaluation of Machine Vibration by Measurements on Rotating Shafts: Unlike ISO 10816, which focuses on non-rotating components, ISO 7919 provides guidelines for measuring vibration directly on rotating shafts. It is primarily used for high-speed rotating machinery, such as turbines, compressors, and pumps, where shaft displacement and dynamic behaviour are critical to performance.

ISO 2631 – Evaluation of Human Exposure to Whole-Body Vibration: This standard applies to human vibration exposure in workplace environments, such as vehicle drivers, heavy machinery operators, and industrial settings. It assesses vibration severity based on acceleration levels and frequency content, helping to establish safe exposure limits to prevent health risks.

Compliance with these ISO standards ensures accurate vibration measurement, consistent evaluation criteria, and enhanced machine reliability, contributing to improved safety and operational efficiency.

03 Vibration Testing Services by AV Industrial Products Ltd



AV Industrial Products Ltd offers professional vibration testing and analysis services, leveraging our expertise in FFT analysis and vibration isolation. Our experienced vibration engineers are available to visit customer sites to conduct in-depth vibration testing, identify problematic vibration sources, and provide expert recommendations.

As part of our service, we provide:

- ✓ **On-site Vibration Testing:** Using high-precision wired and wireless accelerometers, our engineers can capture real-time vibration data under operational conditions.
- ✓ **Comprehensive Analysis:** We apply FFT analysis to evaluate vibration characteristics, detect anomalies, and identify disturbing frequencies.
- ✓ **Technical Reports:** A detailed written report is provided, including the results of the analysis, key findings, and performance assessments.
- ✓ **Expert Recommendations:** Based on the test results, we offer guidance on vibration mitigation strategies, optimal anti-vibration mountings, and corrective actions to improve machinery performance and longevity.

Our vibration testing services cater to a variety of industries, including construction vehicles and machinery, power generation equipment, and general industrial machinery.

04 Conclusion

This study demonstrates the importance of vibration testing in optimising machine performance and ensuring compliance with industrial standards. The comparison between ICE-driven machinery and electrified systems highlights key differences in vibration sources and spectral characteristics. AV Industrial Products Ltd provides expert on-site vibration testing, analysis, and vibration control solutions, delivering actionable insights and technical solutions to enhance operational efficiency and minimise vibration-related failures.

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References

[1] ISO 10816: Mechanical Vibration – Evaluation of Machine Vibration by Measurements on Non-Rotating Parts.

[2] ISO 7919: Mechanical Vibration – Evaluation of Machine Vibration by Measurements on Rotating Shafts.

[3] ISO 2631: Evaluation of Human Exposure to Whole-Body Vibration.