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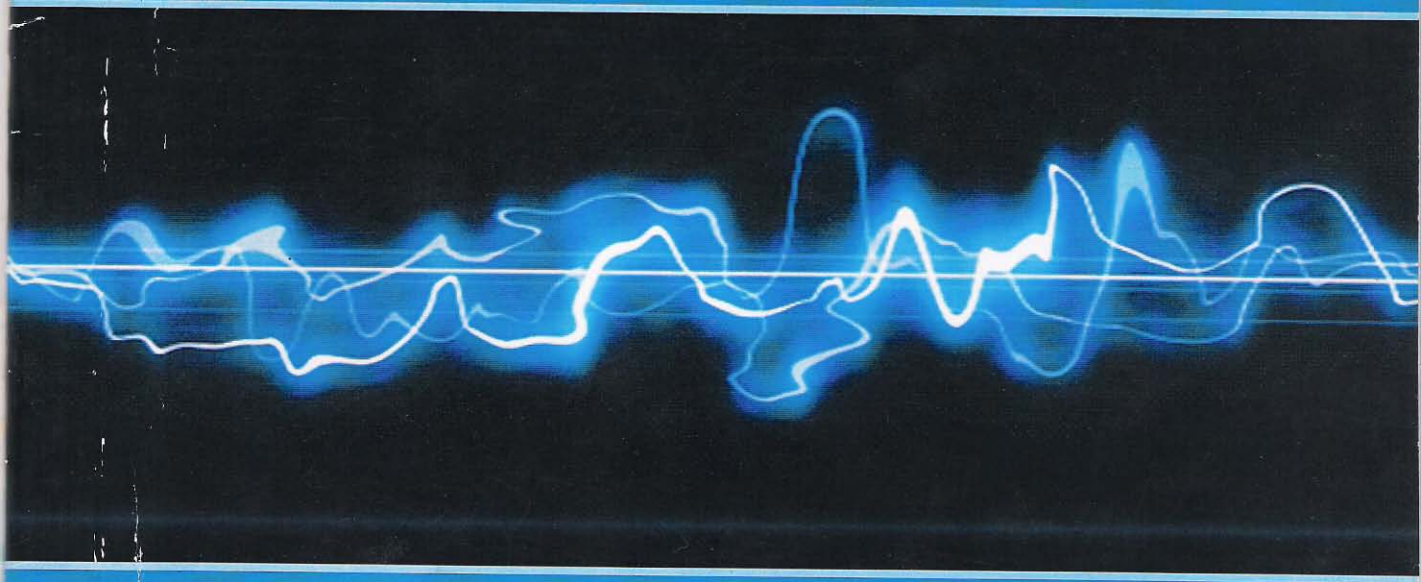
SOUVENIR & ABSTRACTS BOOK



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INVITED TALK

DESIGN CONSIDERATIONS FOR A VIBRATION AND NOISE ISOLATION SYSTEM COVERING HIGHER ACOUSTIC FREQUENCY BAND AND AN ANALOGY BETWEEN MECHANICAL AND MOLECULAR VIBRATION

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ABSTRACT

This is an industrial application oriented article on the design and selection considerations for optimized vibration isolation system . The design and selection depends on the type of machine and the environment. The input for the mathematical design starts from the analysis of Fast Fourier transform (FFT) spectra in frequency domain or time history in the time domain The vibration isolation is achieved by using vibration isolators of passive nature which reduces the damaging effect of high dynamic loadings on supporting structures or vice versa In case of sensitive instruments the vibration of the ground or the supporting structure affects the resolution In general any rotating machine generates vibrations extended to acoustic frequency band . The complex spectra of a machine is a superimposed spectra of the main machine and its sub systems vibration. The FFT spectra show the peaks at vibration frequencies representing the fundamental frequencies and its harmonics of higher orders. The vibration isolation calculation for a rotating machine is shown as an example. The calculated isolation efficiency of Elastomer material-metal bonded isolators and Air spring isolators compared at different input frequencies. An analogy of vibration and rational spectra of a poly-atomic molecule and machine vibration spectra highlighted. The Vibration frequency analysis methodology in Machine dynamics compared to Molecular Dynamics studied in Molecular Spectroscopy at optical and microwave band frequencies In view of the inter-disciplinary

nature of the subject involving Elastic wave propagation, Wave mechanics, thermodynamics, Molecular dynamics and material science, the connectivity to the topic like internal energy, inter -molecular forces, molecular structures, shape configurations related isolator design highlighted. The material behavior under high stress condition and at high frequencies discussed. The mathematical aspects of design and optimization techniques based on Fuzzy and Generic logic briefed. The response curve of a mechanical system excited by a shock wave shows a decay to a quasi static vibration output. The effect is compared to atomic scale perturbations and events in Quantum Mechanics and Tunneling effect in electronics when an electron passes through a potential barrier in a semiconductor material. Glimpses of industry oriented applications in multidisciplinary fields from aerospace to Quantum optical metrology and Laser Holography presented in the concluding slides. The mathematical design calculation results are compared to the actual measurement of vibration isolation after installation and is found to be comparable within an acceptable level of tolerance of +/- 10% .