

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures - Dynamics and Microdynamics (3)

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ANALYSIS OF MICRO-VIBRATION BY HIGH RESOLUTION FORCE SENSING MEASUREMENT
TO REDUCE MECHANICAL NOISE

Abstract

Structural stability of satellites is of vital significance for the operation of sophisticated payload systems. Therefore manufacturers of satellite components, such as reaction wheels, make huge efforts to assure the convenient vibration behavior of their products. To meet that demand Astro- und Feinwerktechnik Adlershof GmbH decided to widen its range of mechanical and environmental test facilities by one device for the measurement of mechanical oscillations with very small amplitudes (micro-vibrations). The described micro-vibration test-bench allows the detection of vibrations with amplitudes >0.0001 Newton in a frequency range of <20 kHz generated by a test item with a mass up to 30 kg. The quality of the thereby obtained data makes it possible to identify the sources of the observed vibration and to initiate appropriate corrective measures. As presented in the paper the overall noise-level of recently inspected reaction wheels could be reduced by a factor of 10 using the micro-vibration test-bench as a wheel balancer. The high information content of the measurements originates from a set of high resolution force sensors, variably arranged on a mechanically isolated platform. The sensitivity of the used equipment (charge cables, charge amplifiers and signal analyzers) and its resistance to ambient disturbances allows the high accuracy of the measurement as mentioned above. The described micro-vibration test-bench additionally provides opportunity to detect production errors non-destructively and helps to reduce the inherent noise of the item under test. It therefore represents a reliable measurement device to quantify and assess detrimental vibrations.