Vibration Isolation Supports Imaging Clarity

In recent years, a growing number of engineers have set up nanotechnology equipment such as probe microscopes, interferometers, and stylus profilers in locations where vibration noise is significant. But as nanotechnology instrumentation becomes more advanced and measurements can be taken at a progressively smaller level, the interference caused by stray vibrations worsens, resulting in diffused and fuzzy images. This problem can be countered, however, using vibration isolation technology.

A passive approach for creating low-vibration environments, negative-stiffness vibration isolation has seen steady growth in popularity in recent years. This form of vibration isolation is effective for improving the imaging clarity of nanotechnology applications, yet is less expensive than similar systems such as pneumatic isolators that use active isolation. "These isolation systems enable vibration-sensitive instruments such as scanning probe microscopes, microhardness testers, and scanning electron microscopes to operate in severe vibration environments such as upper floors of buildings and cleanrooms," explains David L. Platus, president and founder of Minus K Technology Inc. (Inglewood, CA, USA), which has developed negative-stiffness vibration isolation systems. According to Platus, images as well as data produced using the technology are significantly clearer than those produced using pneumatic isolators.

Negative-stiffness isolators employ a mechanical method for isolating low-frequency vibration. Vertical-motion isolation is provided by a stiff spring supporting a weight load, combined with a negative-stiffness mechanism. The net vertical stiffness does not affect the static load–supporting capability of the spring. Beam–columns connected in series with the vertical-motion isolator provide horizontal-motion isolation. The result is a compact passive isolator effective against low vertical and horizontal natural frequencies and high internal structural frequencies. The isolators achieve 93% isolation efficiency at 2 Hz, 99% at 5 Hz, and 99.7% at 10 Hz.

Negative-stiffness vibration isolators from Minus K are used in a range of applications in areas such as biological sciences, semiconductor research, and materials research. The technology also can be used for a variety of medical applications. "One example of a medical application is fluorescent dye imaging equipment for studying neural activity of the brain," Platus says. "The isolators also can be used in electrophysiology setups for patch-clamping or cell manipulation using micromanipulators and microscopes."