Scanning electron microscope platform dampens vibrations in all spatial directions

March 18 2014

Platform dampens vibrations in all spatial directions. Credit: Fraunhofer LBF

Scanning electron microscopes are extremely sensitive and even subtle movements going on around them can affect their accuracy. Vibration control tables already exist to dampen these sometimes barely perceptible disturbances. But now a new kind of isolation platform for the first time integrates sensors and actuators into the mount – resulting in a platform that is more cost-effective and compact than its predecessors.

Whether you're looking at hairy spider legs, the alien-like faces of ants, or the spiky-looking surfaces of pollen – a scanning electron microscope delivers high-resolution images that are rich in detail. But you can't get perfect images unless you protect the microscope from vibration. If someone walking across the room or an elevator going up and down between nearby floors makes the table shake, you're unlikely to get good results. The simplest way to quell vibrations is to put the microscope on a granite base – a stone so heavy that it dampens vibrations occurring at high frequencies from two to three Hertz. Placing a microscope on granite will make it far less susceptible to interference, but not necessarily those vibrations occurring at lower frequencies. When scientists wish to protect sensitive measuring devices from interference, they turn to active damping or, more specifically, an isolation platform. Each of the platform's four integrated swivel-mount modules contains a sensor that measures any vibrations in all three directions and an actuator that counterbalances them in three dimensions.

More cost-effective and compact without compromising performance

Researchers at the Fraunhofer Institute for Structural Durability and System Reliability LBF in Darmstadt have now come up with the first vibration control table of its kind to incorporate function-integrated components. "So instead of using non-adjoining sensors and actuators that are built into the table legs, we have integrated these functional elements directly into the platform's mounting modules," says engineer Torsten Bartel from Fraunhofer LBF. This has the advantage of making the vibration control table considerably more streamlined and cheaper to produce. And practical tests have already shown that the system works. The table dampens interfering vibrations just as well as its traditional counterparts. From April 7-11, the scientists will present their prototype at the Hannover Messe (Hall 02, Booth D13).

So how exactly does this table differ from its predecessors? "Conventional vibration control tables have mounts that are fitted with readymade actuators and sensors that work independently of the table itself. What we have done is to combine these functional elements beforehand within the mounts themselves. We don't use complete actuators – we use a number of interacting components that carry out the same function," explains Bartel. "So instead of having a system of individual elements producing a team effort, as was usual up to now, we have one composite unit." This includes connecting the actuators to the metal springs. Neither the actuator nor the springs could work on their own – they can only work together to protect the table.

"We can tailor our system to a variety of applications," says Bartel. This includes adaptations according to the size and weight of the equipment used – the table takes a different design if it is for, say, an electron microscope, than it would if it were meant for a smaller and lighter device. Reconfiguring the tables' geometry is the top priority here and simply making a smaller table is not enough. Changes in geometry affect the rigidity of the various elements. Similarly, the actuators and sensors take on a different design depending on the nature of the device: the larger the mass, the harder the actuators have to work in order to counteract vibrations.

Provided by Fraunhofer-Gesellschaft