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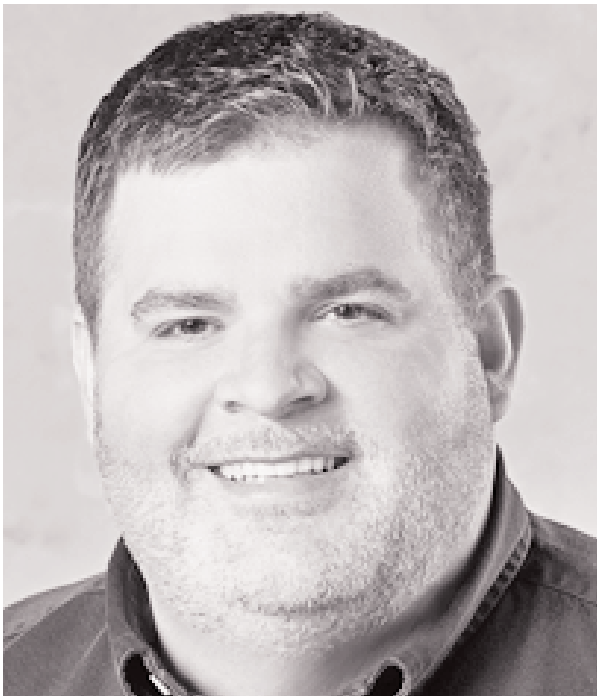
Latvis Interview Reprint

Interview with... Michael Latvis

by Richard Hardesty

Michael Latvis has devoted his career to vibration control. He has degrees in mechanical engineering and design, over twenty years of experience and thousands of hours of professional training including product design, development and manufacturing in industries focused on interior noise reduction and vibration isolation systems for commercial aviation; helicopter rotor bearing, engine and transmission vibration isolation systems; army and navy weapon systems shock and vibration isolation products; and industrial computers and electronics vibration isolation systems. He holds three US patents and various international patents related to shock and vibration isolation products and has published and presented a number of papers about vibration and noise control products in various industries.



Mike plays the trumpet and has always loved music and home audio systems. In 2000 he founded Harmonic Resolution Systems (HRS) to develop products specifically for high-end audio and video equipment. His decades of technical experience combined with a dedication to music make him a perfect candidate for an **Audio Perfectionist Journal** interview.

Readers may want to know: is the listening room really filled with lots of vibrating energy? Where does this vibration come from? Does this vibration degrade sound produced by an audio system? Can vibration control devices eliminate vibration? Will eliminating or minimizing vibration actually make sound better? Let's consider these questions separately and see what Mike Latvis has to say.

Can vibration cause audible degradation or is this just another way for accessory manufacturers to make money by selling products that "solve" a non-existent problem?

Vibration and mechanical noise cause a significant audible degradation of the signal. That vibration causes this degradation is somewhat less obvious to many people but the end result is signal damage. The loss of information and added artifacts caused by vibration and noise can remove the essence of what makes a high-end audio system a special experience for the listener. The sonic improvements made with well-designed noise reduction products are not only significant but also unique in nature and cannot be achieved by other means.

What are the sources of vibration that affect audio components? In other words, what shakes our audio components? Does this energy enter the components from the supporting rack or directly through the air?

There are several sources of vibration in an audio system. The most significant and obvious sources of noise in the vast majority of systems are the speakers. The energy from the speakers takes more than one path to your components where it becomes an issue.

Speaker-generated noise may take one of two primary paths to the components. (1) Structure-borne noise is vibration transferred from the support structure to the audio components. The structure can be excited directly from the floor or from the air. (2) Airborne noise is energy transmitted from the drivers of the speakers to the air which in turn energizes the components, the room, and all of the structural devices (shelves, etc.) supporting the components.

Can vibration really degrade the performance of audio components other than mechanical devices like turntables and perhaps CD players?

Our engineering tests, listening tests, and experience with a very wide range of Harmonic Resolution Systems customers, using a very wide range of systems and configurations, all confirm that vibration and noise can significantly degrade the performance of an audio system. We find that a majority of components that have electronic circuits that generate, transfer, or carry the signal directly can be audibly improved by addressing the impact of vibration and noise that reaches the component circuit.

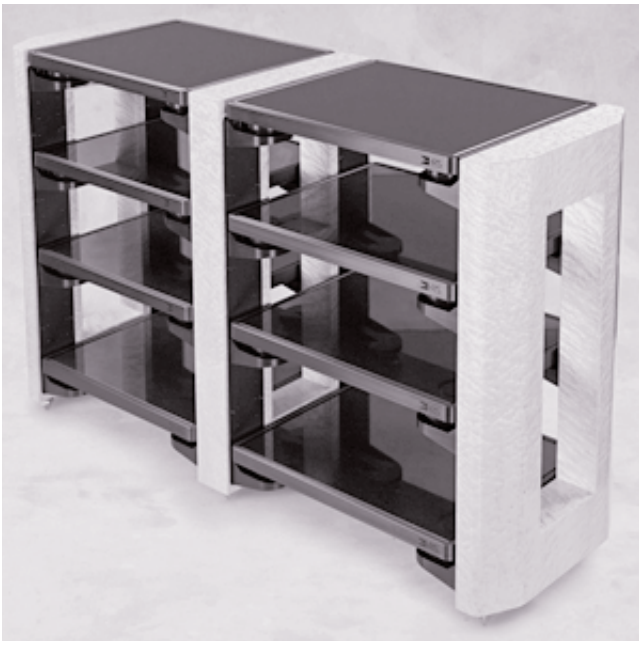
How can vibration affect solid-state components, like preamps, that don't appear to be microphonic?

This is a great question because at first glance this may not be obvious to many people. There seems to be a more general acceptance that turntable performance can be improved by reducing mechanical noise that reaches the stylus. It is obvious that the turntable cartridge is an accelerometer reading the frequency and amplitude of the grooves in the album. The cartridge converts the mechanical motion to an electrical signal, which is then amplified to drive the speakers. Because the cartridge is converting mechanical motion to an electrical signal, most people can see clearly that erroneous mechanical noise that also reaches the stylus will be converted to electrical noise and that this noise will likely damage signal quality.

What is less well known to audiophiles is that there are many other devices that convert mechanical noise to an electrical signal. In industry these devices are commonly used to measure stress in parts, the dynamic response of mechanical systems, and the frequency and amplitude of vibrating systems. A host of other measuring devices are used in many processes and product applications. All of these devices take a mechanical event and convert it to an electrical signal in order to easily process and use the information.

One of the most common devices used by engineers to measure mechanical motion is a strain gauge. A strain gauge is very simple and consists of a relatively thin wire bonded to a film. The film is then bonded to a mechanical part. A charge amplifier is used to put an electrical signal through the wire. When the part under test moves, the thin wire changes form and the result is a change in resistance. The change in resistance is measured as a change in voltage through the device. The

mechanical motion is now read as an electrical signal. This mechanical-to-electrical conversion through a simple wire is so reliable that engineers developing critical aircraft systems and many other products use it to measure stress, frequency, and vibration amplitude. Companies all over the world use strain gauges every day.



Another way to convert mechanical motion to an electrical signal is by use of piezoelectric-based materials. The piezoelectric devices are often man-made or naturally occurring crystals, such as quartz crystals, that produce a charge output when they are compressed, flexed or subjected to any force. The electrical signals from piezoelectric materials are used daily to measure mechanical acceleration by monitoring the electrical response of these crystals.

The crystals used for vibration and noise measurement are similar in nature to the parts used in digital-to-analog conversion (DAC) circuits. The fundamental understanding that the most common way to measure force, pressure, vibration, and shock is by taking advantage of the many electrical devices that change characteristics in response to these mechanical events, provides the necessary insight to see that a high performance electronic audio circuit that contains many different electrical components is very likely to respond to the vibration and noise to which these components are subjected.

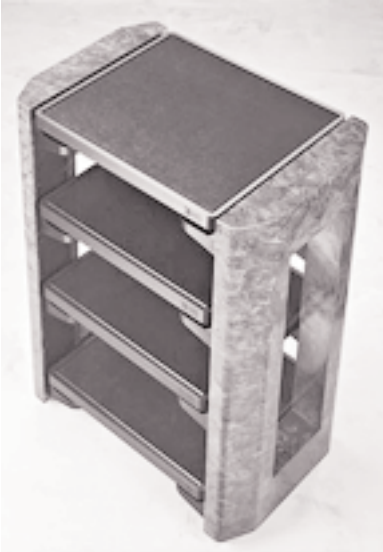
With this understanding we can then begin to imagine the number of different locations in a high performance audio component where the signal quality may be degraded by vibration and noise. We can then also see that if the environment is changed in any way we might hear this change. More importantly, if this vibration and noise are reduced in a significant way we can reduce or even eliminate the damage to signal quality by reducing or eliminating the mechanical noise affecting the component. Reducing noise that degrades the signal provides the listener with a new level of information. Now he can hear just the signal and a unique level of detail and nuance from the actual recording.

Do points, spikes and rubber feet placed beneath audio components reduce vibration or just change the frequency? I've heard the sound change when Jenga Blocks are placed beneath a solid-state preamp but this eludes most explanations based on science I understand. What's really happening here?

Our experience at Harmonic Resolution Systems Inc. is that with a wide range of high performance audio systems you cannot change anything that touches the chassis of an audio component without changing the "sound" of the component. Based on our discussion of how electrical circuits are sensitive to vibrations, you can see that any time you touch a component chassis with another object you change the response of that structure to vibration and noise. The change that you hear when you place an object in contact with a component is the change in the chassis' response to the new object or the change in location of that object. This change may or may not improve the sound.

Whether you have just changed the environment or truly improved the environment depends on how well the product being used was engineered and how effective this solution is with the component chassis it is being applied to.

It seems intuitive that heavy objects are more difficult to move than lighter ones. Wouldn't a big, heavy support rack stop vibration problems?



This intuition is actually true to some degree because Newton's second law is that F=MA. For a given force (F) the level of acceleration (A) on an object will be lowered as the mass (M) increases. However, mass has another effect on system response. As mass increases, changes occur in the natural frequency of a system because mass is part of that relationship as well.

If the natural (or resonant) frequency of the object coincides with the input frequency (vibration) then you might actually amplify vibration. Mass also decreases acceleration of an object in a linear manner. If we want to significantly reduce the vibration by multiples of 10, 100 or even 1000, mass alone may not be the most practical way to achieve high levels of noise reduction. So in general you can make improvements by increasing mass in a knowledgeable way. But with a more complete approach that takes advantage of mass along with a number of other engineering principles you can reduce vibration and noise to a much greater extent.

The reference level MXR Audio Stand by Harmonic Resolution Systems does weigh in at about 500 pounds for a four-shelf system but it also contains many other materials and technologies that contribute significantly to the performance of this system. Without these other technologies the performance is significantly reduced.

Can vibration control products actually eliminate vibration that a heavy rack can't?

Yes, the application of many different technologies can actually be much more effective than just adding mass. If you look at the Harmonic Resolution Systems M3 Isolation Base we do have a shelf weight of approximately 65 pounds, but we also use a custom-designed primary isolation stage that is set based on the load of the component and greatly reduces the magnitude of the noise before it reaches the mass. The M3 Isolation Base also contains seven different materials and more than forty parts to make up a complete system that reduces noise and resonance within the frame itself. I firmly believe that a well-executed complete system approach will outperform a design approach that maximizes only one design variable.

In the 1970s people were building isolation boxes for turntables. Is this still a good idea?

It is a very good idea if they are built in a manner that reduces the level of noise reaching the stylus in a known way. The principles we have discussed are not new. Accelerometers and the knowledge of mechanical-to-electrical conversion go back well before the 70s as do the principles of reducing vibration and noise. The fundamental principles involved are not new but the detailed understanding and the dedicated application to high performance audio, which started with turntable suspension systems many decades ago, is now being taken to a new level.

At Harmonic Resolution Systems we have spent the last seven years developing a complete line of materials and products specifically for high-end audio systems that allow you to reduce signal degrading noise to an entire system at each and every component. This work, and work by other companies dedicated to the high-end audio industry, has allowed us to achieve a new level of performance that until recently was not available to audiophiles.

Will we hear an audible improvement that justifies the cost of vibration control products?

Based on our experience and feedback from our customers over the past seven years, the answer is yes. You will definitely hear a very significant improvement that more than justifies the cost of the products. You must set your well-thought-out and carefully selected components on something. This is not an option. What you select to put your components on and in contact with will definitely impact their performance. I think your expenditure should be proportionate to the rest of your system. We use a general rule that 10% to 30% of your system cost should be invested in well-designed mechanical noise reduction products. This will

ensure that the rest of your investment is delivering peak performance and that you will hear the music in a way that can only be achieved with the application of these products.

Thanks, Mike, for an edifying interview. APJ

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