# Instron® TechNotes **Getting the most up-to-date information on materials testing**

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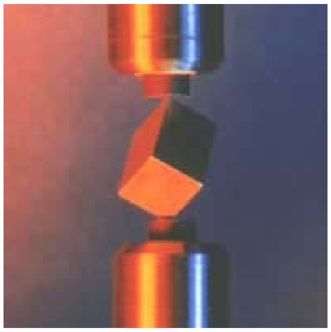
## Application Story

### The Sound of Quality



In the early 1990s, the Los Alamos National Laboratory had a problem. Scientists were studying superconductors – a material that exhibits zero resistance to the flow of electricity. But how could they determine a material's elastic properties (including Young's Modulus and Poisson's ratio) at really cold temperatures? The materials they were studying were high-temperature superconductors, which meant they needed to understand their material properties at -300°F (-185°C), a temperature that is cold enough to make rubber shatter.

Why was this important? If the elastic properties of high-temperature superconductors could be better understood, scientists might be able to raise the temperature range at which materials become superconductors. This would make it possible to conduct very high current electricity with essentially no energy loss. Magnetic Levitation (Mag Lev) trains that "float" resistance-free on a magnetic field might become practical and cost effective.

With that need in mind, Magnaflux Quasar commercialized the technology required to allow laboratories to measure elastic constants at very low temperatures. Their RUSpec system works by exciting and listening to a material's natural resonances over a wide frequency range.

Bells resonate at many different frequencies simultaneously, most of which are at a much higher frequency than the human ear can hear. These resonant frequencies, along with the shape of the sample, can be used to characterize a number of material properties, such as elastic modulus. This capability complements Instron equipment that measures mechanical and some elastic properties. It also provides added information with very high accuracy (up to 0.01%) and can be used over an extensive temperature range.

When using the RUSpec, researchers discovered that some samples sang a different tune – or had a different resonance pattern. The implications of this behavior were later understood when automotive production parts were tested and the patterns of known good and known bad parts were compared. This research confirmed that the resonance of a part can be used to determine its quality. Over the last several years, Quasar has proven that resonance testing is far more accurate at predicting structural performance than other nondestructive testing (NDT) methods.

Quasar was acquired in March 2007, making Quasar a sister company to Instron. Visit Quasar to find out more information on the technology behind their products.

## Tech Tip

### Correcting for Compliance


Materials testing systems subjected to a force will deform, however slightly. This is called compliance and can lead to significant errors in results for certain types of tests. Most materials testing systems measure crosshead or actuator displacement. However, the displacement output recorded by the system is actually the sum of the system compliance and the specimen deformation.

Where very precise measurements of specimen deformation are required, the use of extensometers avoids system compliance errors completely. But what can you do if the use of extensometers in your application is inconvenient or difficult due to test fixturing requirements or test environment – for instance when testing springs or gaskets? In such cases, we suggest using the Compliance Correction feature available in Instron's materials testing software. This feature subtracts system compliance from the load/displacement curve, leaving behind the true deformation of the specimen.

If you are an existing Bluehill®, Merlin™, Series IX™ or Partner™ user, check your software's help system to see if your current version supports this feature. If not, contact us for details on how to upgrade to the latest version.

## You Asked - We Answered

**Q: How can I get better r-value results when using clip-on extensometers?**

A: Determining r-value for ASTM E 517 requires precise measurement of axial and transverse strain. When using clip-on extensometers, make sure you are practicing the following techniques:

1. Set gauge lengths
2. Align instruments on the specimen
3. Zero instruments with no load on the specimen
4. Check that the knife edges do not deform the specimen
5. Be certain that the specimen is not bent
6. Ensure specimen markings haven't deformed the specimen
7. Be certain specimens have smooth edges and meet ASTM E 517

**What do you think? Tell us!**


INSTRON
Worldwide Headquarters
825 University Avenue
Norwood, MA 02062-2643 USA
http://www.instron.com/