



*Acoustical Society of America*  
*Washington DC Regional Chapter*

is hosting

**A Tour of the CUA Acoustics Laboratory and lectures  
by Professor Joe Vignola and Teresa Woods**

at

**The Catholic University of America, Washington DC**

**Tuesday September 29, 2009**

- 6:30 PM Sign in and social (Complimentary food and beverages)
- 7:00 PM Lab Tour by Pat O'Malley
- 7:30 PM "Novel exploration of the vibration of the caribbean steelpan in response to authentic excitation"  
by Teresa Woods
- 8:00 PM "Spectral and temporal shaping of system response  
using an array of subordinate oscillators"  
by Professor Joseph Vignola

This meeting will be held at:

**CATHOLIC UNIVERSITY OF AMERICA**

620 Michigan Ave. N.E.

Washington, D.C. 20064

School Of Engineering

Pangborn Hall, Scullen Room, 1st Floor

Driving Directions: <http://publicaffairs.cua.edu/direct.htm>

Metro: <http://www.cua.edu/centers/metromap.cfm>

ASA — DC chapter: [www.AcoSoc.org/RegChapters/WashDC/](http://www.AcoSoc.org/RegChapters/WashDC/)

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# **NOVEL EXPLORATION OF THE VIBRATION OF THE CARIBBEAN STEELPAN IN RESPONSE TO AUTHENTIC EXCITATION**

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## **ABSTRACT**

A conformal scanning laser vibrometer was used to determine the vibrational modes of a C-lead tenor steelpan. The measurements provide a rich mechanical snapshot of the artistry involved in the marriage of metallurgy and music theory that goes into the creation of the instrument. The data represents the surface-normal motion of the instrument in response to an impulsive excitation intended to mimic the strike of a mallet. A description of this novel measurement system is presented, followed by the surface velocity data and a summary of response shapes and the frequencies at which those responses occur. The data shows that individual note areas respond when adjacent or non-adjacent musically related notes are struck, and clearly illustrate the complex vibration of the steelpan and the coupling between notes that produce the rich distinctive nature of the steelpan sound.

## **Biography:**

Teresa completed her undergraduate degree in Mechanical Engineering at the Georgia Institute of Technology in 1996, where she also worked in the Underwater Acoustics research group. She then transitioned to the medical device development industry as a research engineer for SpectRx, Inc., developing technology for noninvasive glucose monitoring. She later joined Altea Therapeutics, where she worked on a platform for noninvasive transdermal drug delivery used for a wide variety of pharmaceuticals including insulin, parathyroid hormone, and a pain medications. She returned to school at Catholic University in 2007, where she is currently a PhD student in the Mechanical Engineering department, working in the Acoustics and Vibrations group. Her primary research area is the dynamics of micro- and nano-scale two-dimensional coupled resonator arrays.

# **SPECTRAL AND TEMPORAL SHAPING OF SYSTEM RESPONSE USING AN ARRAY OF SUBORDINATE OSCILLATORS**

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## **ABSTRACT**

The time and frequency responses of an oscillating structure can be tailored by attaching an array of subordinate oscillators. This presentation shows how the system response can be deliberately shaped by prescribing the distributions of the dynamic properties in an array of such subordinate oscillators. An accompanying JASA paper (J. Acoust. Soc. Am., 2009. **126** 1) covers this topic in greater detail. Exact analytic governing equations of motion are derived for the coupled system that is composed of the primary system and the subordinate array. For a relatively small number ( $<100$ ) of attached oscillators whose total mass is small ( $<1\%$ ) relative to the primary structure, it is possible to engineer desired characteristics in the frequency response function of the primary oscillator. For example, nearly linear phase or constant amplitude over a frequency band of interest can be implemented. The band of the attached oscillators determines the frequency range over which spectral shaping occurs. Moreover, increasing the number of subordinate oscillators (without increasing the total added mass) offers a number of advantages in reshaping the dominant system's spectral response. The criterion of producing a "smooth" spectral response and the relationship to the irreversibility of energy flow and equal partitioning of energy will be discussed.

## **Biography:**

Dr. Vignola pursued his higher education at the Georgia Institute of Technology in Atlanta where he obtained his Ph.D. in 1991. Since then, Dr. Vignola has conducted research in structural acoustics at the Naval Research Laboratory in Washington DC, studying the dynamics of micro- and nano-structures. A major area of interest has been fluid and non-fluid damping mechanisms in MEMS. In the Fall 2006, Dr. Vignola left NRL to join the faculty of the Mechanical Engineering department of The Catholic University of America in Washington DC. At CUA, he teaches a variety of graduate classes in acoustics in addition to general undergraduate ME classes.