

## *The 2004 Colloquium Series*

### **SYNTHESIS OF VIRTUAL ENVIRONMENTS FOR ACOUSTIC DESIGN**

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**3:30 P.M.**

**GRIS 276**

#### **ABSTRACT**

Subjective evaluation of noise as part of a multidisciplinary design cycle permits human perception to influence design, and can help direct the development of noise mitigation technology. Such evaluations require time histories that can be presented to listeners for their consideration. Unfortunately, acoustic analyses used in design are typically not well suited for this purpose because results are often available only in the frequency domain as power spectra, or as integrated metrics. Prediction-based sound synthesis offers a means of transforming frequency domain analysis data to the time domain, making it suitable for auditioning. When presented within an immersive virtual environment, it not only enables acousticians and engineers in other disciplines to subjectively evaluate the effect of design changes on acoustic performance, but also can be used to effectively convey noise impact to stakeholders and the affected population.

The ingredients necessary to synthesize virtual environments for acoustic design are discussed in the talk. Tonal and broadband sound synthesis methods are presented. Relevant propagation effects including absolute delay, Doppler shift, atmospheric absorption, spreading loss, and binaural simulation are also considered. Finally, the system architecture needed to integrate all elements within a real-time, three-dimensional, immersive virtual environment is presented. Recent NASA Langley applications to aircraft community noise and interior acoustics are discussed.

#### **BIOGRAPHICAL SKETCH**

Stephen Rizzi is a 1985 (M.S.) and 1989 (Ph.D.) graduate of the School of Aeronautics and Astronautics, Purdue University. He joined the NASA Langley Research Center in Hampton, Virginia in 1989 and is presently a senior researcher in the Structural Acoustics Branch. His research interests include sound synthesis, virtual acoustic simulation, nonlinear structural dynamics, and acoustic fatigue. Since 1991, he has served as the Sonic Fatigue Group Leader, performing and directing structural acoustic research in support of the National Aerospace Plane, High Speed Research, Aerospace Vehicle Systems Technology, and Next Generation Launch Technology programs. Since 2000, he has also been responsible for pioneering a new avenue of research focused on the development of simulation tools for acoustic engineering applications. In this capacity, he has led research in support of the Intelligent Synthesis Environment and Quiet Aircraft Technology programs. Dr. Rizzi is an Associate Fellow of the AIAA, and member of the Acoustical Society of America and the Society for Experimental Mechanics. He has authored or co-authored over 60 peer-reviewed publications, conference papers and technical reports.

*An informal coffee & cookie reception will be held prior to the lecture at 3:00 p.m. in GRIS 390*