

THURSDAY
NOVEMBER 11, 2004

Scaife Hall Auditorium
Room 125

4:00 PM
Refreshments—3:30 PM



Ramani Duraiswami
UNIVERSITY OF MARYLAND

Ramani Duraiswami is on the faculty of the department of Computer Science at the University of Maryland, College Park, and directs research at the Perceptual Interfaces and Reality Laboratory there. He has broad research interests in the varying areas of computational audio (microphone arrays, virtual auditory displays, scene recreation), computer vision, numerical analysis, and scientific computing. His book (with Nail Gumerov) titled *Fast Multipole Methods for the Three Dimensional Helmholtz Equation* will be published by Academic Press in November 2004.

More information on his research can be obtained at:
<http://www.umiacs.umd.edu/~ramani>

Markus Pueschel, ECE Seminar Host
pueschel@ece.cmu.edu

For more information:
<http://www.ece.cmu.edu/seminar>

CAPTURE AND RENDERING OF PERCEPTUALLY VALID THREE DIMENSIONAL AUDIO

Humans are very good at discerning the spatial origin of sound using a mixture of monaural and binaural cues in disparate environments ranging from open spaces to small crowded rooms. This ability helps us to interact with others and the environment by sorting out individual sounds from a mixture and helps us to survive by warning us of danger over a wider region of space compared to vision. These advantages of spatial sound are also potentially of benefit in the fields of human-computer interaction, teleconferencing, and telepresence.

Our research over the past three years has been focused on the problems of rendering and acquiring spatial audio for such applications. A fascinating aspect of human auditory perception is our ability to extract cues from the scattering of sound off our own bodies. This scattering off our torso, head and especially our external ears changes the "color" of the sound received in a way that depends on the location of the source.

When sound is reproduced over headphones these scattering related modifications must be reintroduced to achieve a perception of real source. The "Head-Related Transfer Function" (HRTF) characterizes how this scattering takes place off an individual. The HRTF shows significant inter-personal variability and must be obtained separately via a tedious measurement process for each listener. This individuality has made it difficult to use the HRTF in applications, and has been a significant barrier to widespread use of spatial audio. Other important cues for perception of spatial audio are provided by the dynamics of the listener and by the scattering of sound off the environment.

In this talk I will present an introduction to the problem of creating and acquiring spatially valid audio, and present our recent results in 1) developing a novel way for extremely fast acquisition of HRTFs for individuals using a combination of scientific computation and ingenious experimentation; 2) a technique for real-time acquisition and "image-based" rendering of soundscapes using multi microphone acquisition using spherical microphone arrays.