Motivation:

The purpose of this 1 credit course is to provide an overview of the recent developments in virtual acoustics, sometimes called 3-D sound, 3-D audio, binaural audio, or spatialized sound. These techniques are now becoming commonplace to provide 3-D sound displays for flight simulators, computer games, and other virtual reality and immersive environments. Virtual acoustic systems will soon be available for use in automobiles. Some of the topics to be covered include:

- Virtual acoustic systems, cross talk cancellation, head related transfer functions, the “stereo dipole,” auralization (including reverberation effects), elements of psychoacoustics for 3-D sound, and applications.

Organization:

Class usually meets in Applied Science Building, Room 214, Wednesdays from 10:10 to 11:00 AM using computer projection facilities. Classes may need to be rescheduled because of instructor conference conflicts. It is anticipated that students will participate in listening tests outside of class, and signup sheets will be provided. Approximately 15 class meetings.

Class co-requisite: ACS 502, Fundamentals of Acoustics II or equivalent.

If you have not passed your Ph.D. comprehensive exam, and wish to sit in on this course, you must take it for AUDIT credit. If you have passed your Ph.D. comprehensive exam or are a faculty or postdoc., you are welcome to simply “sit in” on the course.

Anyone attending class is expected to read the reading assignments before class and to participate in class discussions.

References:

Primary text:

- Durand Begault, *3D-Sound*. Originally this was published by Academic Press in 1994 but is now out of print. Dr. Begault recently has made his book available as a NASA Technical Memorandum, and this reprint will be used for class.

Additional references on reserve in the Engineering Library, 3rd floor, Hammond Bldg:


Papers from the Audio Engineering Society (AES) and the Acoustical Society of America (ASA).
Rough Outline:

lecture number  topic
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1  organization/directional cues
2  conventional stereo versus the “stereo dipole”
3  human subject/psychoacoustic context
4  precedence effect and HRTFs
5  more on HRTFs
6  intensity, loudness, reverberation effects
7  auralization models
8  using DSP with HRTFs
9  LMS approach for crosstalk cancellation
10 multichannel systems
11 head tracking methods
12 implementations: Ambisonics, VMaX, SRS
13 recent papers from the literature
14 recent papers from the literature II
15 wrap up

Grading:

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<tr>
<th>Component</th>
<th>Percentage</th>
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<tr>
<td>Class participation (doing the reading)</td>
<td>40%</td>
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<tr>
<td>Homework/labs (2, I think)</td>
<td>30%</td>
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<tr>
<td>Term paper (3-4 pages)</td>
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There is no final exam. In the term paper you will review a recent article from JAES or JASA on virtual acoustics using the information you have learned in the class.

Class Homepage:

A WWW homepage has been set up for this class:
http://www.acs.psu.edu/users/sparrow/classes/fall2000VACS.html

Please tell me what additional information you would like to see there.

Caveat:

As with any newly developed course we will certainly encounter numerous snags and surprises this semester. Your understanding is appreciated.