Session N. Education in Acoustics: Modeling in Acoustics Education

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Chaiman's Introduction—8:00

Invited Paper

8:05

N1. Acoustical scale modeling in the classroom at MIT. Richard G. Cann (Grozier Technical Systems, Inc., 157 Salisbury Road, Brookline, MA 02146)

This is an actual demonstration of the acoustical scale modeling methods that have been used by the author for several years to help teach some basic acoustics to students in two classes at the Department of Architecture. One class in the curriculum of Building Technology, instructed by Carl Rosenberg of BBN, uses scale modeling to show how the reverberant sound within an interior space forms from numerous wall reflections. Echograms from various model room configurations illustrate simple defects that may occur in the quality of the interior sound. Also, students see demonstrated clearly the difference between the reduction of noise by surface absorption and by transmission loss. Another course attended by equal numbers of undergraduate and graduate students is instructed by Tim Johnson and John Furlong. It explores various aspects of the microclimate. One part, acoustics, is presented in the form of one lecture and a brief acoustical scale modeling demonstration immediately followed by a laboratory activity in which students investigate the control of sound from a highway into a nearby community. Students use the scale modeling instrumentation to help select the appropriate noise barrier that will give an acceptable community noise level, or/and noise reduction, at the lowest cost. There is no one solution to the problem, but students must show their understanding of acoustics by justifying their selection quantitatively.

8:50–9:00

Break

Contributed Papers

9:00

N2. A method to evaluate the acoustical effects of design decisions in the architectural studio class. Gary W. Siebein (Department of Architecture, 231 ARC, University of Florida, Gainesville, FL 32611)

The results of a research project in acoustical modeling conducted by the author were used to facilitate the investigation of acoustical issues in the conceptual stage of the design process of students in a fourth-year architectural studio. The students worked on a semester-long project to design a multipurpose performing arts center. The intent of the studio was to look at the potential of acoustics as a formgiver in architecture. The acoustical modeling technology was used as a mechanism to evaluate the proposed solutions. The technique allowed students to receive immediate feedback on the acoustical quality of a proposed scheme. The results of tests in models of the students' designs were compared to the results of similar tests made in many different auditoria gathered as a part of the research project. Students were able to test many alternative design schemes and understand the resulting changes in acoustical quality (as evaluated by new objective design criteria such as early to late temporal energy ratios and reflectograms) in small-size study models. Once a basic solution was reached, more detailed architectural and acoustical refinement of the scheme followed. The high energy level and enthusiasm of the students and the most satisfactory design projects at the end of the semester attested to the success of this new design tool. [Work supported by NSF.]

9:15

N3. A microcomputer-based demonstration system for musical acoustics education. Robert Maher and James Beauchamp (School of Music, University of Illinois at Urbana—Champaign, 2136 Music Building, 1114 West Nevada, Urbana, IL 61801)

While an ideal musical acoustics education laboratory would include an extensive collection of electronic measurement, recording, and display equipment together with appropriate space, staff, and maintenance staff to support student use, this situation is seldom possible because of limited funds. Our solution has been to configure and program a microcomputer (IBM PC AT) to serve as a mobile multifunction demonstration station. The station is capable of high-resolution color display, stereo audio/digital input/output, hardware FFT analysis, and MIDI input/output. Thus far, the following demonstrations have been completed: (1) animated display simulation of wave propagation on strings and within pipes; (2) waveform/spectrum display and sound synthesis from given Fourier amplitudes and phases; (3) single frame spectrum analysis of audio signals; (4) display simulation of modes on square and circular vibrating membranes; and (5) sound synthesis comparison of just, Pythagorean, and equal-tempered scales. One advantage of this microcomputer-based system is that new demonstrations can be incorporated easily by writing new programs for the existing hardware. [Work supported by an IBM grant to UIUC.]