9:25

5aAA6. Acoustics of early music spaces from the 11th to 18th century: Rediscovery of the acoustical excellence of medium-sized rooms and new perspectives for modern concert hall design. Alban Bassuet (Arup Acoust., 155 Ave. of the Americas, New York, NY 10013, alban.bassuet@arup.com)

The acoustical characteristics of 50 rooms that played a prominent role in the history of music between the 11th and 18th centuries were studied. The rooms include basilicas, oratorios, organ churches, and the great halls and courts of the European palaces. The research provides an understanding of the acoustical features that suit the early music repertoire, and how these rooms achieved an enhanced emotional engagement through their unique acoustical characteristics. This paper provides a summary of the acoustic measurements, which include binaural and B-format recordings in each of the rooms, and presents a unique new approach to understanding their subjective characteristics through detailed analysis and auralization of their 3-D impulse response. The study shows that the timing and direction of reflections in three dimensions is critically important to defining the subjective characteristic of a room. The results emphasize the importance of developing techniques to understand the 3-D impulse response and using auralization techniques for interpreting results and making subjective judgments. The enhanced musical experience that is achieved in these early rooms offers an invitation to rethink modern acoustics and to develop a new design approach that focuses more strongly on the subjective response and emotional engagement of the music.

10:35

5aAA7. Use of surrogate samples to study variation of absorption coefficients of fiberglass with altitude. Richard D. Godfrey (Owens Corning, Sci. and Technol., 2790 Columbus Rd., Granville, OH 43023)

ASTM C 423 identifies air temperature and relative humidity as significant parameters, but does not address air density effects. At constant temperature, air density decreases approximately 20% from sea level to 5000 ft altitude. In previous papers, normal and diffuse field analysis showed significant changes in predicted absorption coefficients with altitude. These predictions were validated experimentally for normal incidence by making measurements in a vacuum chamber. Reverberation chambers cannot withstand depressurization. They also exhibit significant interlaboratory measurement variability. Another method was soot. The Mechel design charts are normalized by two parameters. One is not dependent on air density. The other is the ratio of flow resistance and the impedance of air. If thickness is held constant, the effect of lowering air density can be studied by increasing the sample flow resistivity of the sample. This surrogate sample should emulate absorptive performance at high elevations in sea level laboratories. Impedance tube measurements using surrogate samples emulated the effects observed in the pressure chamber study. The next step is to use surrogate samples to investigate air density effects in diffuse fields using the ASTM C 423 test method in a single laboratory.

10:50

5aAA8. Acoustical phenomenon in ancient Totonac's monument. José Sánchez-Dehesa, Andreas Håkansson (Nanophotonic Technol. Ctr. and Dept. of Electron. Eng., Polytechnic Univ. of Valencia, E-46022 Valencia, Spain), Francisco Cervera, Francisco Meseguer (Polytechnic Univ. of Valencia, E-46022 Valencia, Spain), Betsabé Manzanares-Martínez, and Felipe Ramos-Mendieta (Univ. of Sonora, Hermosillo, Sonora 83190, Mexico)

The circle of gladiators is a monument built by Totonac Indians in the ceremonial site of Cempoala, which is located near Veracruz (Mexico). The city is believed to date to around 1200 A.D. The monument is a round structure with crenellated wall tops, and it has a diameter of 13.4 m. Though the deterioration of this monument is noticeable, it presents a singular acoustical phenomenon whose strength had to be probably extraordinary on the date of its construction. In brief, along any diameter in the circle, one can find two focal points such that if one person speaks on one focus, another person located on the other hears the sound reinforced. In other words, this circular place acoustically behaves as if it were elliptical. Here, we report the experimental characterization of the phenomenon and present a theoretical explanation. Also, the intentionality of the Totonacs is speculated since these people are associated with the Mayan culture, which is known by its realizations of environments with astonishing sonic properties. [Work supported by CEAL-UAM of Spain.]

FRIDAY MORNING, 28 MAY 2004 NEW YORK BALLROOM A, 8:00 TO 10:45 A.M.

Session 5aAOa

Acoustical Oceanography and Animal Bioacoustics: D. Van Holliday Special Session on Acoustical Measurements of Marine Organisms III

John K. Horne, Chair

School of Aquatic and Fisheries Science, University of Washington, Box 355020, Seattle, Washington 98195-5020

Contributed Papers

8:00

5aAOa1. Twenty-five years with Van Holliday in the development of high-frequency technology and analysis algorithms to measure zooplankton distributions. Richard E. Pieper (Southern California Marine Inst., 820 S. Seaside Ave., Terminal Island, CA 90731, pieper@usc.edu)

Initial studies using high-frequency acoustics at four individual frequencies (0.5–3.0 MHz) were begun in the 1970s to measure acoustical scattering from zooplankton. Acoustical measurements were made at sea by profiling vertically in the water column. Zooplankton were collected, identified and measured, and target strength measurements were made on individual zooplankton in the laboratory. Concurrently, various acoustical scattering models were analyzed to enable the calculation of the size-frequency distribution of zooplankton from the acoustical data. A multifrequency acoustic profiling system (MAPS) was then developed (21 different acoustical frequencies). This system was used to measure oceanic structure off of southern California, plumes off of central California, Gulf Stream features, and oceanic structure in the Irish Sea. Analyses of these data indicated that 21 frequencies were more than needed. Four to six frequencies were adequate for most studies, and the Tracor Acoustic Profiling System (TAPS) was developed. This system has been used and modified for a wide variety of studies. These studies range from large-scale patterns of zooplankton in the Arabian Sea to the measurement of thin layers in many different oceanic systems. The use of these systems now provides us with high-resolution measurements of zooplankton distributions in the sea.