models of both static and rectified diffusion underestimate the rate of bubble growth by 10%–20%. The discrepancy is demonstrated by comparing predictions based on existing mathematical models with direct numerical solutions of the differential equations for gas diffusion in the liquid and heat conditions in the bubble. The Rayleigh-Plesset equation is used to describe the bubble dynamics. Underestimation of bubble growth by existing mathematical models is due to the underlying assumption that the gas concentration in the liquid is given by its equilibrium state for a bubble of constant radius. This assumption is violated when high supersaturation causes the bubble to grow too fast in relation to the time scale associated with diffusion. Rapid bubble growth results in an increased concentration gradient at the bubble wall, and therefore a growth rate in excess of predictions based on quasistatic gas concentrations. [Work supported by ONR.]

FRIDAY MORNING, 30 NOVEMBER 2007 NAPOLEON B1, 9:00 TO 10:00 A.M.

Session 4aEA

Engineering Acoustics: Topics in Engineering Acoustics

Daniel M. Warren, Chair
Knowles Electronics, 1151 Maplewood Drive, Itasca, IL 60134

Contributed Papers

9:00

4aEA1. Effect of leakage in Helmholtz resonators. Iljae Lee, Ahmet Selamet, and H. S. Kim (The Ohio State Univ., 930 Kinnear Rd., Columbus, OH 43212, Selamet.1@osu.edu), and Norman T. Huff (Owens Corning, Novi, MI 48377)

The effect of leakage in Helmholtz resonators has been experimentally and numerically investigated. Transmission loss of a Helmholtz resonator having a gap between the cavity and main duct is measured using an impedance tube setup. The effect of leakage on the transmission loss is examined using different amounts of gap openings. Experimental results are then compared with the predictions from the boundary-element method. The study shows that the leakage increases the resonance frequency substantially and widens the transmission loss. Hence, the leakage needs to be taken into account for accurate predictions of Helmholtz resonators.

9:15

4aEA2. Optimization of baffle configurations to prevent aeroacoustic instabilities in heat exchangers: Preliminary experiments. A. Miguel Moreira (College of Technol., Setubal Polytechnic Inst., Campus do Instituto Politcnico de Setubal, Estefanilha 2910-76, Portugal, mmoreira@est.ips.pt), Jose Antunes, Vincent Debut, Martins Paulino (Inst. of Nuclear Technol., Portugal), and Heitor Pina (Tech. Inst., 1049-001 Lisboa, Portugal)

Gas heat exchangers are prone to aeroacoustic instabilities, which often lead to severe noise levels, structural vibrations, and fatigue. Actually, this problem is solved by placing rigid baffles inside the container, which modify the acoustic modal fields and eventually inhibit the instability. For realistic industrial components using a restricted number of acoustical baffles, their optimal location is a challenging problem, as trial and error experimentation is often a costly and frustrating procedure. Recently, some strategies were proposed for the optimal location of a single baffle in a typical re-heater from a power station boiler, based on simulated annealing as well as genetic algorithm approaches. In this paper and using the above-mentioned optimization strategies, a more complex case of the problem—the optimal location of a given number (two or more) of baffles in a typical re-heater, was addressed. Some preliminary experiments were performed and compared with the simulation results. From the discussion, improvements in the developed optimization functional were proposed. [This work has been endorsed by the Portuguese FCT and POCI 2010, with funding participation through the EC programme FEDER (Project No. POCI/EME/5728/2004).]

9:30

4aEA3. Digital reconstruction of sound using array of microspeakers. Kassiani Kotsidou and Charles Thompson (ECE Dept., Univ. of Massachusetts Lowell, Lowell, MA 01854)

This work examines the digital reconstruction of sound using the method of matched asymptotic expansions. We will study an array of microspeakers and in particular, the role the cut off frequency and the damping ratio have in the successful reconstruction of sound. The transducers are fed by pulses whose duty cycle will be studied and its ramifications will be reported. We will consider how the coupling between the transducers affects the performance of the overall system.

9:45

4aEA4. Personal sound system design for mobile phone, monitor, and television set; Feasibility study. Chan-Hui Lee, Ji-Ho Chang, Jin Young Park, and Yang-Hann Kim (Ctr. for Noise and Vib. Cotrol, KAIST, 373-1 Guseong-dong, Yuseong-gu, Daejeon 305-701, Republic of Korea, chance99@kaist.ac.kr)

Having a personal sound system that does not need to use an earphone or any wire connected microphone would have great interest and potential impact on the associated industries. A device that uses nonlinear characteristics of high intensity ultrasonic sound, such as a parametric array, enables us to localize the sound on any position we want. However, it requires a fairly significant amount of power consumption. Therefore, the mobile phone or note book computer system cannot accept this type of device. Instead, we have attempted to use a line array speaker system to localize the sound in our listening zone. It is known that sound pressure or intensity can be well focused in the zone of interest: For example, see [J.-W. Choi, Y.-H. Kim, J. Acoust. Soc. Am. **111** (2002)]. We applied the method to see the possibility to make a good bright zone around the human head or ears. Depending on the size of the zone and array parameters, for example, array size, speaker spacing, frequency characteristics of the speakers, the quality of the bright zone is changed. The quality means the ratio of sound energy between the bright and dark zone, regarded as acoustic contrast, analogous with what we use for an optical device.