inexpensive and their use has the added benefit of decreasing the strain on the environment. Specimens were made with a different volume fraction of cenospheres (0% to 70% in increments of 10) to observe the change in acoustic properties with an increase in the cenosphere content. Specimens of different sizes were tested to study the acoustic characteristics of the materials for a wide range (125 to 4000 Hz) of frequencies. The effect of an increase in the cenosphere content on the dilatational wave velocity in the specimens was also studied with the help of acoustic transducers. It was noted that, although the wave velocity remains relatively unaffected with a change in the cenosphere content, the addition of cenospheres improves the sound absorption characteristics of the cement matrix and asphalt concrete with a considerable decrease (up to 41%) in the density of the material. It has also been noted that the sound absorption of cement increases with the addition of cenosphere up to 40% volume fraction and starts decreasing with the further addition of cenospheres.

9:15–9:30 Break

9:30

3aSAa6. An equivalent solid (u) formulation for poroelastic materials. Dominic Pilon and Raymond Panneton (GAUS, Dept. of Mech. Eng., Univ. de Sherbrooke, 2500 boul. de l'Universite, Sherbrooke QC J1K 2R1, Canada)

Finite element formulations based on Biot's poroelasticity equations have been used extensively throughout recent years. The most common are Biot's displacement ($\underline{u},\underline{U}$) and mixed displacement-pressure ($\underline{u},p$) formulations. They are used to predict the structural and acoustical behavior of poroelastic mediums within multilayered structures. These models, while accurate, lead to the resolution of large linear systems: they need, respectively, six and four degrees of freedom per node in order to efficiently describe the poroelastic medium's vibroacoustic behavior in 3-D problems. In this paper, a simplified displacement ($\underline{u}$) formulation is presented. It is also based on Biot's equations, but requires only three degrees of freedom per node, related to the solid phase displacement field, to describe the behavior of poroelastic mediums in 3-D problems. The development of the governing ($\underline{u}$) equations for the equivalent solid poroelastic formulation is detailed. The limitations of this approach are also discussed. Numerical and experimental validations are presented in order to show the accuracy and effectiveness of the formulation within its prescribed field of application.

10:00

3aSAa7. Genetic encoding for sound package configuration optimization. Heng-Yi Lai (Dept. of System and Network, United Technologies Res. Ctr., 411 Silver Ln., MS129-17, East Hartford, CT 06108, laih@utrc.utc.com)

The acoustic properties of poroelastic materials can be accurately predicted by the Biot–Allard model if the required acoustic parameters have been successfully characterized. In conjunction with the transfer matrix approach, one can use the model to analytically design an acoustic liner comprising different materials that can provide better performance or cost reduction advantages over their homogeneous counterparts. However, optimizing the layer configuration remains to a challenging task as it is a combinatorial problem and the search for the optimal configuration can be difficult or expensive if simply based on the build-and-test approach. The Generic Algorithm (GA) was identified as a better optimization method over the gradient-based methods for this task due to its nature in finding the combinatorial solutions. This approach is, to the best of our knowledge, novel in applying the GA to this design problem. The performance of the GA method is compared with the exhaustive search in maximizing the sound absorption coefficient of an acoustic liner with constraints set for its cost, thickness, and total weight. The features of the Generic Algorithm and the preliminary proof-of-concept results will be discussed and presented.

10:15

3aSAa8. On the dynamics of fuzzy structures. Jean-Mathieu Mencik and Alain Berry (GAUS, Mech. Eng. Dept., Univ. of Sherbrooke, Sherbrooke, QC J1K 2R1, Canada, Jean-Mathieu.Mencik@gaus.gme.usherb.ca)

In this presentation, one proposes a prediction at low- and mid-frequencies of the dynamics of fuzzy structures. As introduced by Soize, the term "fuzzy structure" designates a master structure, whose geometrical, material characteristics, boundary conditions, and excitations are known, coupled with complex systems, called the structural fuzzy or fuzzy, whose characteristics are imprecisely known. Previous works done on this subject analyze the concept of a master structure coupled with a locally homogeneous fuzzy, composed of a large number of linear oscillators excited by their supports. In the present work, the concept of a homogeneous fuzzy is extended to an elastic continuum medium. One theoretically formulates the action of the elastic fuzzy on the master structure: it is shown that the proposed formulation is different from the solution proposed by Soize, derived from the model of a linear oscillator excited by its support. The proposed theory is successfully applied to the case of a homogeneous structural fuzzy composed of a large number of elastic bars whose lengths and cross sections are randomly chosen.

10:30

3aSAa9. Dissipation induced by substructures and distribution of vibratory energy in a complex system. Sunghoon Choi and Yang-Hann Kim (Dept. of Mech. Eng., KAIST, Science Town, Taejon 305-701, Republic of Korea)

This work is concerned with the problem of energy transfer that takes place between a master structure and the substructures attached to it. The response of the system is characterized by the impedance of the substructures and it determines whether the induced damping is real or apparent. When the dissipation is real the master structure has a larger loss factor than that of the substructures and there will be continuous transfer of vibratory energy from the master structure to substructures. However, in the case of apparent damping, one can observe that the vibration energy is transferred back and forth between the master and substructures. Some combinations of the master and substructures have been considered to examine this phenomenon and to determine the criteria for damping. It has found that a modal overlapping condition, which corresponds to bandwidths that exceed the spacing of those natural frequencies, is crucial in determining the characteristics of the system damping. The result of this paper is consistent with that found with the fuzzy structure and SEA framework. [Work sponsored by Ministry of Education, Korean Government under the BK21 program and Ministry of Science and Tech., Korean Government under National Research Lab. program.]