Defence Seminar

Seminar Title	: Simulation and Experimental Verification for Acoustic Attenuation of Intuitive Designs of Periodic Scatterers and Combination with Acoustic Panels
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Abstract : This thesis endeavors design, simulation, and experimental verification of periodic scatterers with an aim to attain elevated acoustic attenuation in broadband by suggesting intuitive designs such as shells having the helical slit, multi-resonant scatterers such as coaxial combinations of resonant shells, and hybrid configurations by installing acoustic panels within the rows of periodic scatterers followed by a time-domain pulse separation based measurement technique to calculate the free-field insertion loss (IL) and echo reduction (ER) in the room environment. As the estimating acoustic performance of periodic scatterers during the design phase has been observed indispensable, the finite element method (FEM) based simulation having appropriate boundary conditions has been shown reliable enough to calculate the insertion loss (IL) with corroboration to the corresponding band structure. The calculated IL for periodic cylindrical and C-shaped scatterers have been presented which agree adequately with the experimental measurements, carried out in an anechoic chamber. With the parametric study of periodic C-shaped scatterers, it has been shown that on increasing the slit width, the IL around the Bragg band is getting reduced which has been addressed by an intuitive design modification such as altering the vertical slit of the shell to a helical shape. The associated tunable parameters of local resonance have been studied and the elevated IL has been demonstrated via simulations accompanied by a comparative study with periodic C-shaped scatterers. After achieving elevated IL with periodic locally resonant scatterer, the multi-resonant scatterers have been designed intuitively by combining two resonant shells such as C-shaped scatterer (C) and perforated scatterer (P). Three decoupled bandgaps other than the Bragg band have been discovered with suggested multi-resonant scatterers which are CC, PP, CP, and PC scatterers, which is more than the combination of the resonance peak of participant resonant shells. Next, the hybrid periodic scatterers have been explored where the porous acoustic panels have been installed within the rows of scatterers and the elevated IL in broadband has been shown to be achieved. On installing the porous panels, the IL is getting elevated in post Bragg band which is even if more than the summation of IL corresponding to the individual participants such as periodic scatterers and parallel porous panels. Next, the time domain pulse separation technique has been demonstrated to calculate the IL and ER of periodic scatterers via simulation first.