Department of Mechanical Engineering

COLLOQUIUM

Numerical and Experimental Investigation of a New Aeroacoustic High Frequency Wave Bypass Filter

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It is possible to reduce the sound emissions emitted from an intake or exhaust nozzle by the help of destructive interference (DI). For this purpose, a tunable sound filter has been designed to be benefitted for a variable frequency region and has been investigated numerically and experimentally. The filter does consist of a main passage (main duct) and a circumferal spiral passage – taking role as a bypass - which are connected to each other by two regions: splitting region and recombination (rendezvous) region respectively. The tuning function is stated as a tool to adjust the relative path difference between these passages. This paper's motivation is to put the DI sound filtering mechanism forth as a benefit for kHz order frequencies and also the tunability function of the design. The filter also does not contain any obstacles interfering the fluid flow generating any additional pressure losses as in the conventional muffler designs. The generated results are based on the passive filtering effect of the bypass duct. The acoustic transmission losses (TL) are tried to be examined 1) numerically with and without fluid flow and 2) experimentally only for the case without fluid flow on Elbüken's Acoustic Filter (EAF). Numerical simulations have been conducted in Ansys CFX® 14.5 on a multiprocessor workstation via local parallel processing with the default zero reflection wall boundary treatment. Based on the numerical simulations, time domain responses to perturbing acoustical inlet noise have been recorded and transformed to frequency domain responses by using a Characteristics Based Filter (CBF) and Fast Fourier Transformation (FFT) in order to calculate the scattering matrix coefficients after filtering acoustic data from the entangled flowfield. Sound pressure level measurements have also been made in order to verify the filtering behavior of the EAF. The numerical and experimental results are concluded to be consistent in getting the maximum benefit for an arbitrary tune position for the in-phase wave components' superposition (thus the case independent of the reflection characteristics of the walls). The results underline the successive use of DI adapted to the filtering apparatus. As a futurework the experiments are planned to be conducted with maintaining nearly zero reflecting boundaries in order to compare with the numerical predictions.

Double B.Sc. degree from Physics and Mechanical Engineering Departments of Yıldız Technical University in 2006 and 2008. M.Sc. Degree from Aeronautics and Astronautics Engineering Dept. of İstanbul Technical University in 2013. Started working life as a mechanical design engineer in EM-GLASS. Worked as a project research assistant in Fluids Group in İTÜ ME Department. Was the engineering kickstarter, R and D Team Leader and Project Manager of AIRONN. He is currently working as an R and D Engineer in R and D Heating Laboratory of Alarko Carrier mainly on Gas and Liquid Fuel Burners and Condensing Gas Boilers' technology and product development. His current field of study include combustion, aeroacoustics, vortex induced vibrations (VIV), heat transfer, turbomachinery and implementation of these with numerical methods on product development.

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