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Effect of external acoustic excitation on NACA0015 discrete tonal noise (Article)

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Abstract

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The purpose of this work is to investigate the effect of external acoustic excitation on the discrete tonal noise generated by laminar boundary layer instability. Experimental testing inside anechoic wind tunnel was done on NACA0015 in order to measure the sound spectrum at low Reynolds number of $Re \sim 10^4$ and angle of attack of 0° , 3° and 5° . The effects of excitation amplitude of 70 dB and 90 dB and excitation frequency of 3000 Hz and 2000 Hz on the airfoil discrete tones were investigated. Exciting at excitation frequency closed to the primary frequency was found able to suppress tonal noise, however, is highly dependent on the angle of attack and freestream velocity. The airfoil was found to have a strong preference in its tonal frequency regardless of excitation. No change was found on the dependency of the secondary frequency. Each individual frequency was found to have $\sim U^{0.8}$ dependency with freestream velocity that is similar to that without excitation. In general, observation shows acoustic excitation only affect the behavior of the primary frequency. The primary frequency dependency at $\alpha = 0^\circ$ was found changed to $\sim U^{2.0}$ with acoustic excitation at 3000 Hz and 90 dB and at 2000 Hz and 70 dB. © 2018 Elsevier Ltd

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