Use of Sonic Crystals for noise mitigation in the launch pad

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An unusual context for the acoustics is the environment of a launchpad during the launching of space aircrafts. This acoustic environment has traditionally received much less attention than other variables as temperature or gases flow. Adopting solutions for the control of noise that now result unsatisfactory is necessary since payloads are becoming more and more sensitive and may be affected by the strong acoustic loads during the lift-off. In this context, the use of acoustic metamaterials based on Sonic Crystals emerges as a practical possibility to build up a metadiffuser that prevent acoustic loads over the spacecraft. A proof of concept based on the use of Sonic Crystals (SCs) as a noise mitigation method in the first stages of the lift-off of space rockets has been proposed as a first step of the study, analyzing both theoretically and experimentally the diffusion coefficient and the Insertion Loss (IL) in reflection of four different SCs with different lattices and filling fractions, using a flat reflector as a reference for the quantification of the noise reduction. The experimental study of a system in the linear regime consisting of a sound source radiating a SC in water partially covering an open cavity is performed. Due to the spreading of the reflected waves, a broadband noise reduction in the area of the source is observed.

Keywords: sonic crystal, launch pad, noise mitigation, diffusion coefficient, insertion loss

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