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Helicopter interior noise reduction using compounded periodic struts

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This paper characterizes the performance of a novel compounded gearbox periodic strut controlling the noise in helicopter cabin through modeling, simulation and experimental research. The strut exhibits low transmissibility in the specified frequency ranges, called “stop bands”. Based on a certain helicopter model, a dynamic acoustic-structure coupling system is firstly built by using the finite element method and the transfer matrix method. Subsequently, according to the gear mesh vibration transmission path, vibration and noise reduction characteristics analysis are conducted respectively. Comparing with the plain strut, attenuations of both vibration and noise in excess of 60dB are obtained in simulations. On a specially designed helicopter platform, experimental research is carried out simultaneously in two aspects of fuselage vibration and cabin noise. The effectiveness of the novel strut used for helicopter cabin broadband noise reduction is demonstrated by the coincidence of the simulation and experimentation results, where attenuations of measured fuselage vibration and cabin noise exceed the level of 40dB and 30dB respectively in the frequency range from 300 to 2000 Hz.

I. Introduction

The vibration of mid- and high-frequency harmonic generated by gear meshing in the main gearbox is one of the dominant sources of helicopter cabin noise [1-3]. The typical frequency range locates between 500 Hz and 2000 Hz which influences human’s subjective reaction greatly [1]. The vibration can be carried by the support struts between the main gearbox and the fuselage, and radiate structure-borne noise into the cabin [4-5]. Thus, the cabin noise can be controlled by suppressing the vibration transferred to the fuselage. Currently, two main methods are used to address this problem.