

Towards a Lining Integrated Active Structural Acoustic Control System

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ABSTRACT

For future aircraft counter-rotating open rotor (CROR) engines are a promising technology to reduce their CO₂ footprint. Since the contribution of CROR engines to the cabin noise is higher than for jet engines, new strategies for the reduction of noise transmissions for frequency bands below 500 Hz are necessary. Active structural acoustic control (ASAC) systems are capable to reduce sound transmission of lining structures in this bandwidth. Sensors measure the vibrations of the lining to estimate its sound emission into the cabin. Based on these signals a controller calculates force signals for actuators on the lining. The actuator forces change the vibration behaviour of the lining in order to reduce its sound emission. For the realization of such a system in a real aircraft, manufacturing and maintenance issues have to be addressed.

Within work package 3 of the EU project ACASIAS an aircraft lining with an integrated ASAC system is developed. The size of the lining is app. 1300 x 1690 mm² (W x H) and it is simply curved. The radius of 2980 mm makes it relevant for a twin-aisle aircraft like the Airbus A350. The focus of research activities lies on the integration of components and the industrial manufacturing process of the lining. The components to be integrated are sensors, actuators and the corresponding wiring. A concept is proposed where each actuator and sensor is encapsulated in a kind of insert. The inserts smoothly integrate into the manufacturing process of the lining while they protect the actuators and sensors from humidity, dust, etc. The maintenance aspect is covered by the option to change each actuator or sensor upon insert level. The integrated wiring of the lining is left unaffected during an actuator or sensor replacement since connectors in each insert allow a nearly tool-free assembly/disassembly.

In this paper the progress of work package 3 is presented at a detailed design review (DDR) stage. Finally, the lining will be manufactured and equipped with a full ASAC system. Experiments will be conducted in the acoustic transmission loss facility at the DLR.