ACOCTIA
Active Control Of Cavity Tones In Aircrafts

Reducing aircraft noise pollution: A comprehensive study of airframe cavity noise.

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Short description

The noise generated from a commercial aircraft's airframe during landing approach is as loud as or even louder than noise from its engine. The noise produced by an airframe's cavity or opening is of particular importance. Intense tone noise could be generated when flow passes over a cavity. This tone noise is considered as fluid-dynamic oscillation noise. Yet another type is fluid-resonant oscillation. The European Commission has set down an environmental objective to reduce air traffic noise by 10 dB per aircraft operation until 2020.

With this in mind, the EU-funded ACOCTIA (Active control of cavity tones in aircrafts) project set out to decrease airframe noise as a consequence of landing gear cavities. ACOCTIA worked on the state of art in the field and implemented hybrid passive/active strategies. Through a passive control approach, cavity design was considered to ensure that any resonant coupling between the cavity frequencies and the fluid-dynamic and fluid-resonant oscillations are minimised. In integrating hybrid concepts, researchers examined the active/passive control of the aircraft cavity tones. Experimental validation in the anechoic chamber were also carried out.

Objectives

The objective of this IEF project focuses on the source noise reduction of airframe noise due to the open cavities; specifically the cavity tones produced as a result of a fluid-dynamic or fluid-resonant oscillation, with the aim to generate solutions that will bring improvement towards the ACARE objectives.

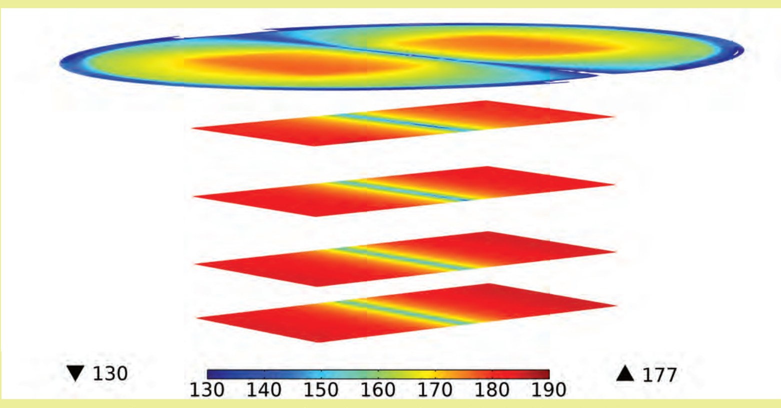
Fig 1: Numerical mode: (1,0,0); 368 Hz

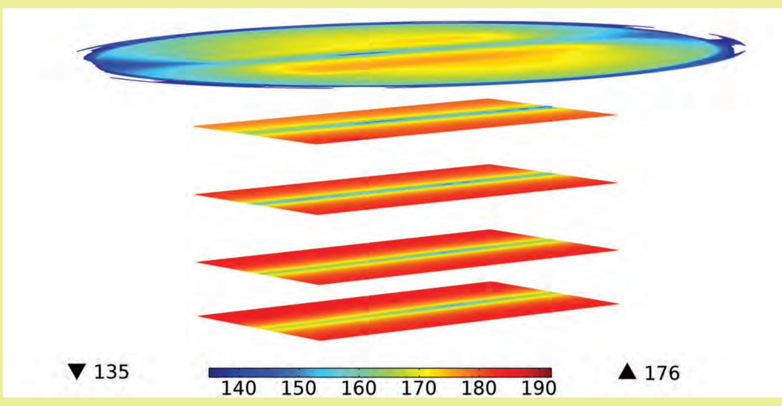
Fig 2: Numerical mode: (0,1,0); 569 Hz

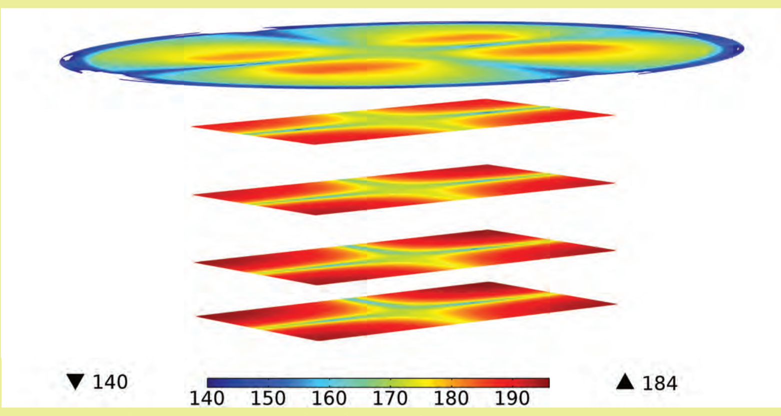
Fig 3: Numerical mode: (2,0,0); 654 Hz

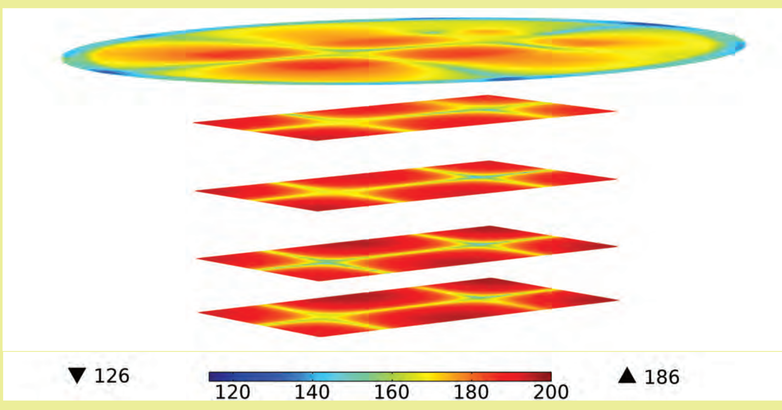
Fig 4: Numerical mode: (2,1,0); 863 Hz

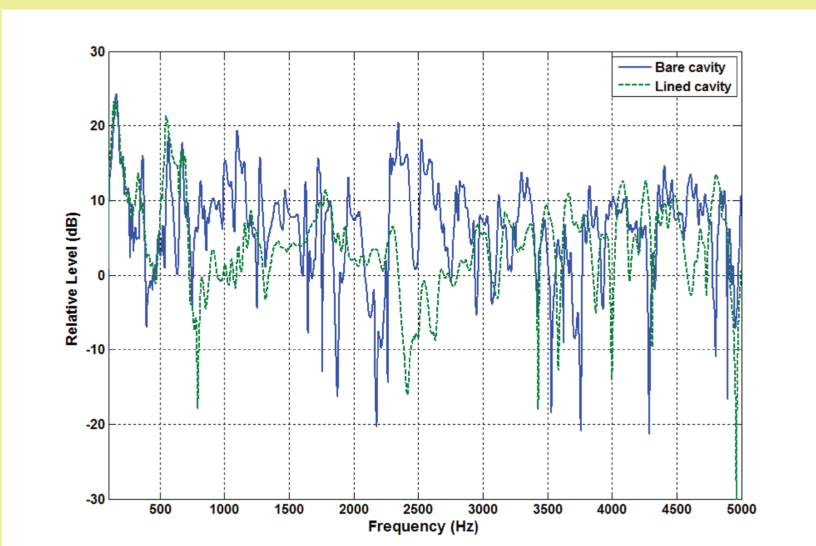

Fig 5: FRF, with and without MPP lining at a point at the lower part of the cavity

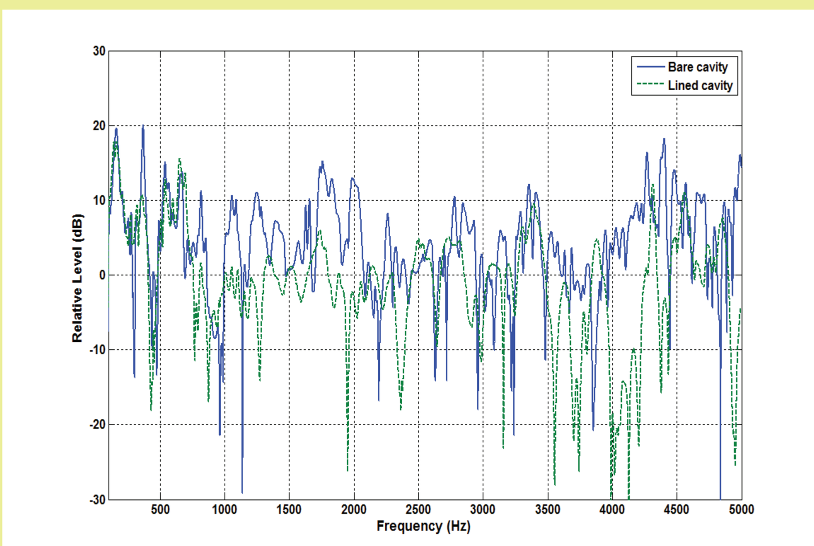

Fig 6: FRF, with and without MPP lining at a point at the upper part of the cavity

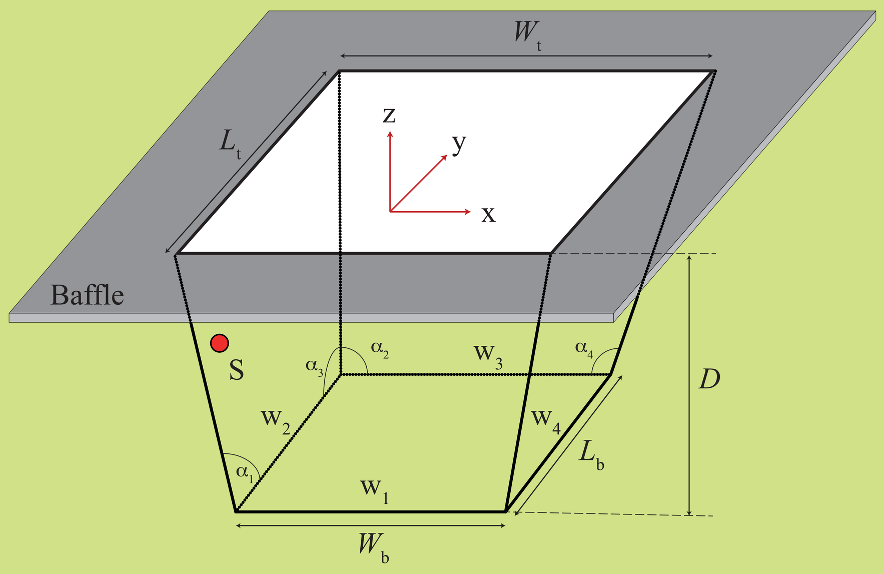

Fig. 7: The open cavity.


Fig. 8: The open cavity lined with MPPs.

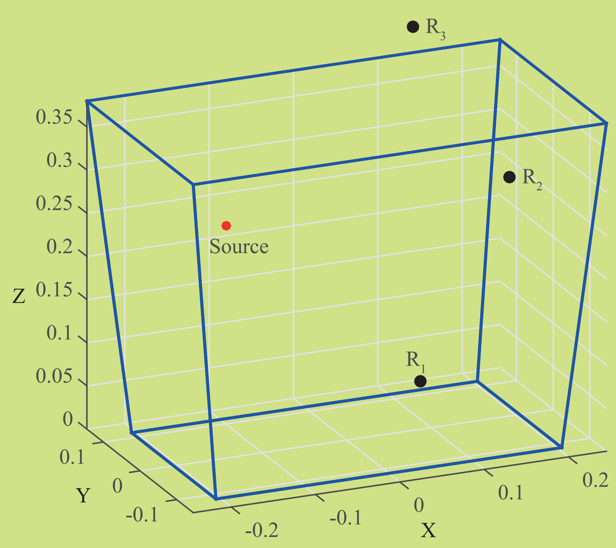

Fig 9: Source and Receiver (R1, R2, and R3) positions.

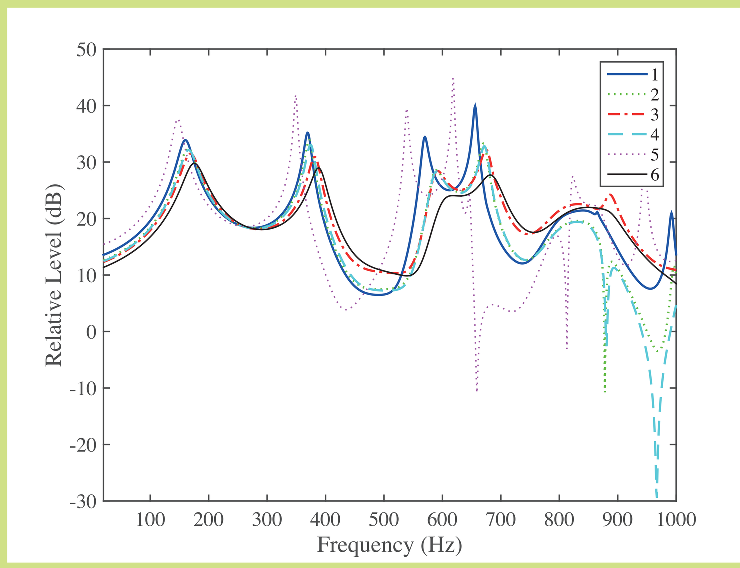

Fig 10: Simulated FRF at the Receiver R1 for different geometry configurations

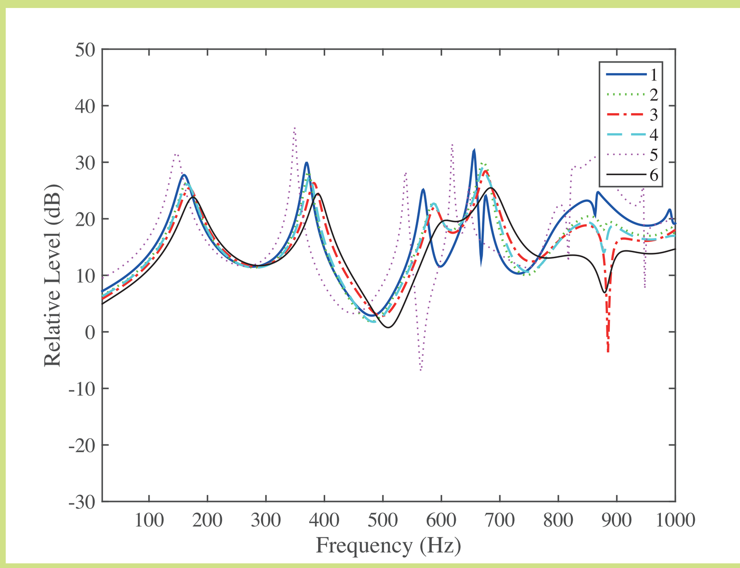

Fig 11: Simulated FRF at the Receiver R2 for different geometry configurations.

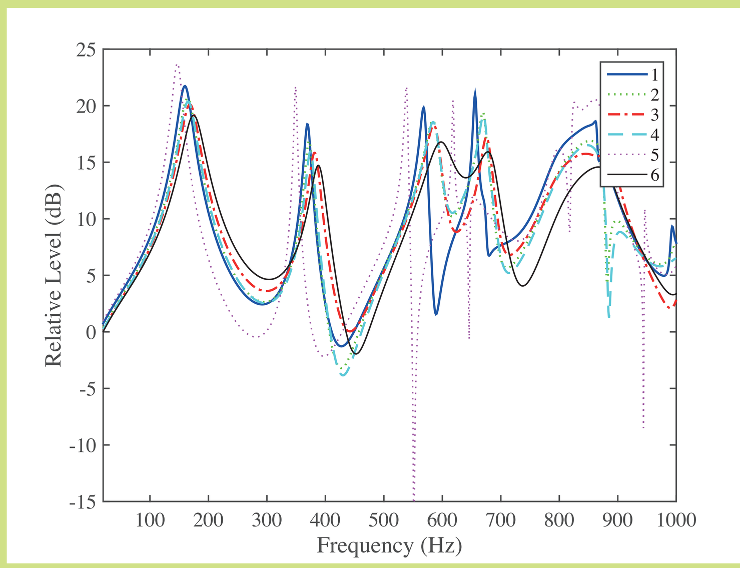

Fig 12: Simulated FRF at the Receiver R3 for different geometry configurations.

Conclusion

- **Passive control strategies:** the effect of lining the inner wall of an open cavity with MicroPerforated Plates (MPPs) fabricated by inflitration is to attenuate the resonance peaks in the frequency band where the MPPs were disign to absorb sound. The effect of lining the inner wall of an open cavity in the acoustic field inside and outside the cavity has been presented.
- It has been shown than changing the geometry of the cavity modifies the resonance frequencies of it. It has also been observed that at high frequencies, where the passive strategies are more efficient, the attenuation is larger and the influence is higher inside the cavity that outside the cavity.

Acknolegment

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European Commission | Marie Curie Actions

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