ACOCTIA

Active Control Of Cavity Tones In Aircrafts

SEVENTH FRAMEWORK PROGRAMME

MARIE CURIE ACTIONS

CSIC
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Attenuation of acoustic resonances in an open cavity using Micro Perforated Panels (MPP).

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Short description

Airframe noise is equal to or louder than engine noise during the landing approach of a commercial aircraft. With the growth of air traffic as well as the ever-increasing level of urbanisation around most airports in Europe, the annoyance near airports is increasing, and the environmental concerns and noise certification regulations make the study of airframe noise an important research topic. The European Commission, within the Advisory Council for Aeronautics Research in Europe (ACARE) has set an ambitious environmental objective; a noise reduction target for the air traffic noise of 10 dB reduction per aircraft operation as the first 2020 goal (CALM 2007).

Cavity noise is one of the most important airframe noises. When airflow passes over an open cavity, due to vortex shedding at the upstream edge of the cavity and the geometry of the cavity, high-level aero-acoustic noise may be generated. When the incident acoustic waves produced by the airflow couples with the acoustic cavity resonances intensive tones are generated in and around the cavity at resonant discrete frequencies. Sound radiation due to the acoustic cavity resonances in an open cavity could be achieved by passive means such as lining the walls with absorbent materials. Porous and fibrous materials are used where there is no airflow. However, in presence of airflow, Micro Perforated Panels (MPP) and Porous metals are employed instead.

This poster presents experimental, theoretical and numerical results of the attenuation of acoustic cavity resonance tones in and around of an open cavity with lined Micro Perforated Panels.

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.

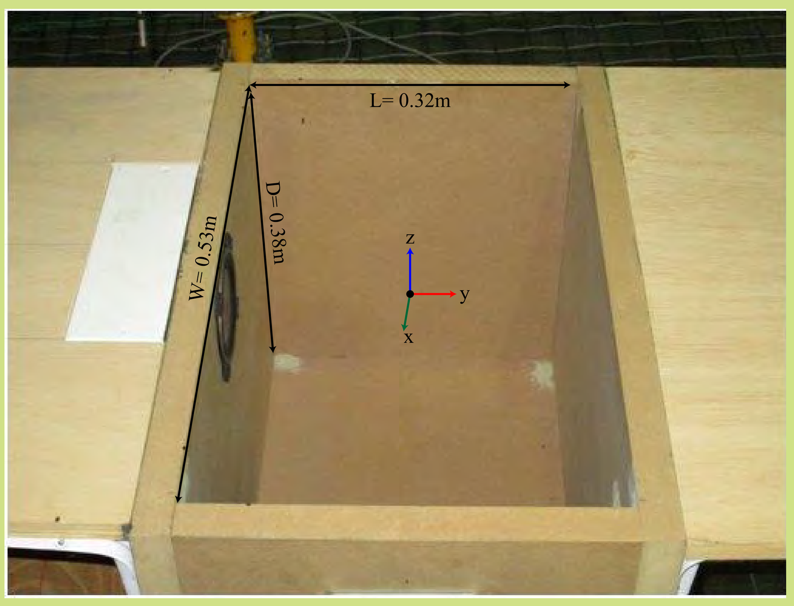

Fig. 1: The open cavity.

Fig. 2: The open cavity lined with MPPs.

Peak at FRF	Mode (x,y,z)	$F_{exp.}$(Hz)	$F_{the.}$(Hz)	$F_{numerical}$(Hz)
1	(0,0,0)	157	151.4	163
2	(1,0,0)	374.5	Not seen	368
3	(0,1,0)	575	549	569
4	(2,0,0)	680.9	659.8	654
5	(2,1,0)	863.4	854.5	863
6	(0,2,0)	1103	1090	1091
7	(2,2,0)	1290	1270	1269
8	(4,1,0)	1430	1431	1461
9	(4,2,0)	1642	1646	1631

Table 1: Resonance frequencies of the open cavity.

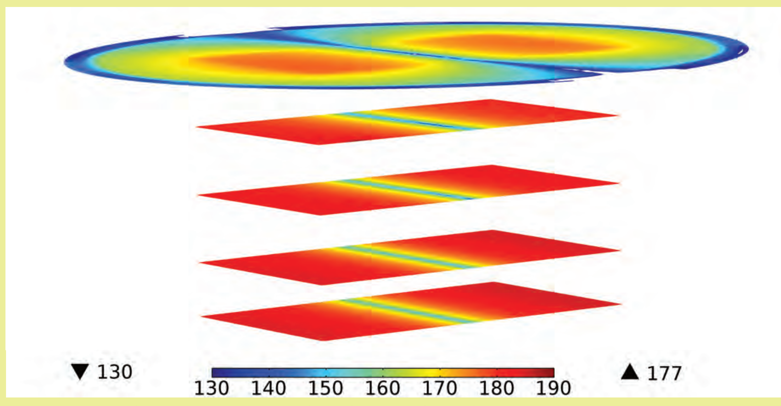

Fig 3: Numerical mode: (1,0,0); 368 Hz

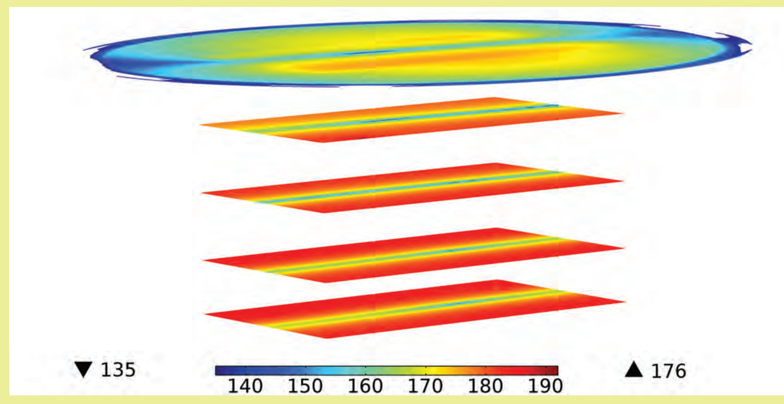

Fig 4: Numerical mode: (0,1,0); 569 Hz

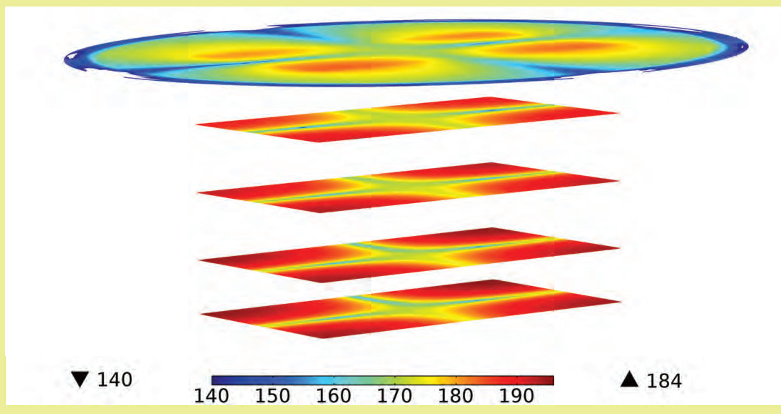

Fig 5: Numerical mode: (2,0,0); 654 Hz

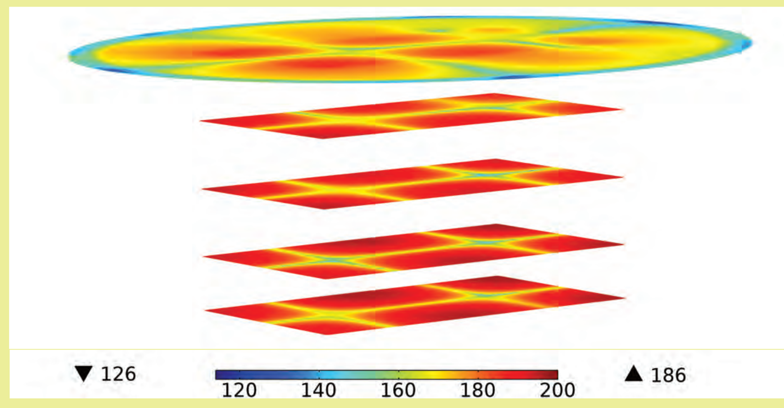

Fig 6: Numerical mode: (2,1,0); 863 Hz

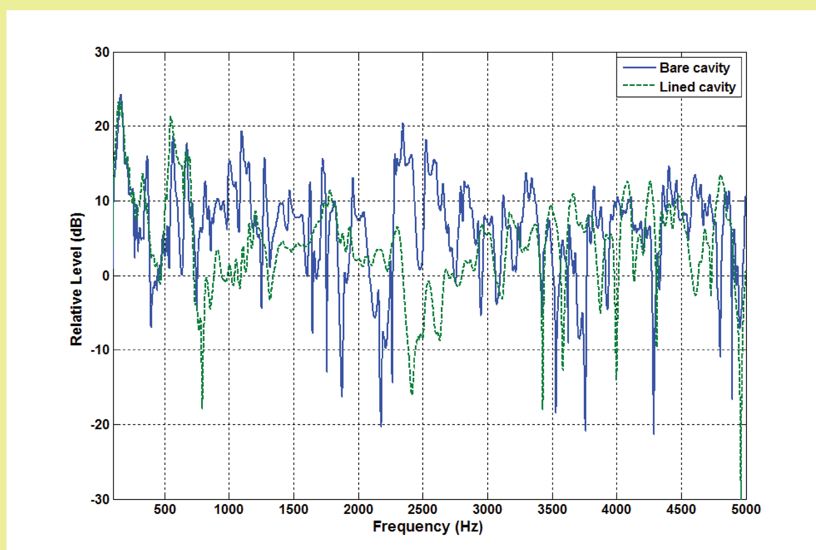

Fig 7: FRF, with and without MPP lining at a point at the lower part of the cavity

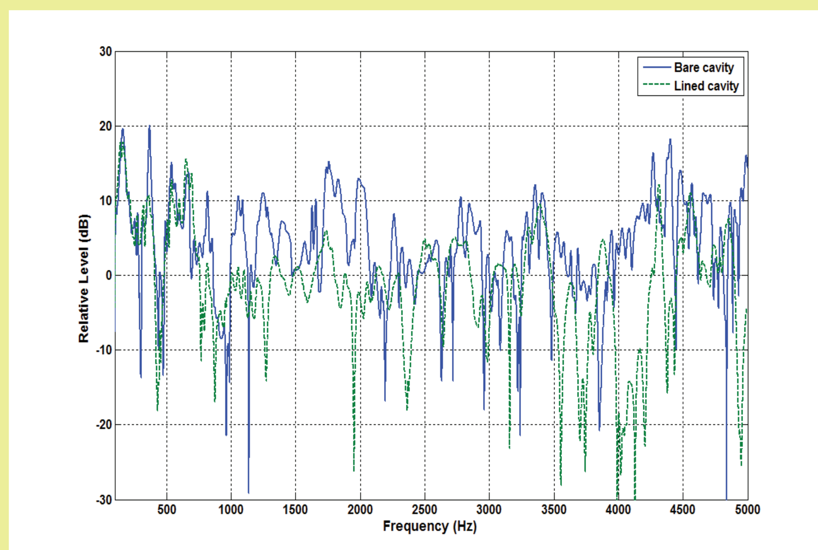

Fig 7: FRF, with and without MPP lining at a point at the upper part of the cavity

Conclusion and Future work

- **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.
- Dising consideration of the an open cavity.
- Active control Strategies.

Acknolegment

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References

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