ACOUSTICS2008/3005
Experimental investigation of the acoustic black hole effect for vibration damping in elliptical plates

François Gautier[a], Jacques Cuenca[b], Victor Krylov[c] and Laurent Simon[b]
[a]Laboratoire d'Acoustique de l'Université du Maine, Avenue Olivier Messiaen, 72085 Le Mans, France
[b]LAUM, CNRS, Université du Maine, Lab. d'Acoustique Université du Maine, UMR CNRS 6613, 72085 Le Mans Cedex 9, France
[c]Loughborough University, Department of Aeronautical and Automotive Engineering, Ashby Road, LE11 3TU Loughborough, UK

It is well known that flexural waves in beams or plates slow down if their thickness decreases. A beam or a plate with a decreasing thickness in the vicinity of one of their boundaries can be designed so that the travel time needed for a wave to reach the edge becomes infinite. Thus, the reflection coefficient associated with the corresponding region is zero. This effect is referred to as the acoustic black hole effect. The use of 'acoustic black holes' in combination with thin damping layers for wedges of power-law profile has been theoretically and experimentally studied by V.V. Krylov and R.E.T.B. Winward (JSV 300 (2007) 43-49). The aim of this paper is to show experimentally the acoustic black hole effect in a two-dimensional configuration comprising an elliptical plate with a pit of power-law profile placed in one of its focuses. The elliptical shape of the plate induces a focalization of waves towards the black hole, which is observed by means of scanning laser vibrometry. Comparison of input mobility measurements for plates with and without black hole shows the reduction in vibrational level induced by the black hole effect.