ACOUSTICS2008/2715
Computing high frequency vibrations of polygonal plates by the Image Source Method

Jacques Cuenca[a], François Gautier[b] and Laurent Simon[a]

[a]LAUM, CNRS, Université du Maine, Lab. d'Acoustique Université du Maine, UMR CNRS 6613, 72085 Le Mans Cedex 9, France

[b]Laboratoire d'Acoustique de l'Université du Maine, Avenue Olivier Messiaen, 72085 Le Mans, France

The aim of this paper is to show that the Image Source Method (ISM) can be used for predicting medium and high frequency vibrations of arbitrarily shaped polygonal plates with controllable precision. Modeling the vibrations of polygonal plates by ISM consists in superposing the contributions of elementary image sources, which allows the plate boundary conditions to be satisfied. For particular plate shapes leading to a spatially periodic pattern of image sources, it is shown that ISM allows the exact computation of the Green's function by means of a Poisson summation formula. For arbitrarily polygonal plates, a criterion for truncating the image source generation process is examined and used as a control parameter for the precision of the estimations. The given examples show that the results are in good agreement with exact analytical solutions for simple plate shapes and with results obtained by the finite element method for more complex shapes. The convergence towards reference solutions as the number of image sources is increased is investigated. The main advantage of the method is that the accuracy is improved with structural damping and with frequency for a given number of image sources.