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Investigating the importance of geometrical accuracy acoustic simulation: A comparison of NURBS and mesh-based approaches

Tomás Méndez Echenagucia[1], Louena Shtrepi[2], Elena Badino[3], Arianna Astolfi[4]
ETH Zurich, Stefano-Franscini-Platz 1, HIB E 45, 8093 Zurich, Switzerland
Politecnico di Torino, Corso Duca degli Abruzzi 24, 10129 Torino, Itali

ABSTRACT

Previous studies have shown that discrete representations of concave surfaces used in geometrical acoustic (GA) based simulations systematically underestimate the sound energy in focal points and planes. This paper investigates the use of NURBS geometry to more accurately represent the distribution of sound energy being reflected from curved surfaces of different geometries. NURBS geometry has the capability to describe mathematically complex curved surfaces, in a non discretized way. In addition, the normal vector at any point of these surfaces can be extracted and used in the calculation of the reflection angles that are required in GA models. This paper investigates the opportunities of using NURBS geometry in the design and modelling of curved acoustic reflectors for concert venues by comparing objective parameter simulation data to traditional mesh- based geometry simulations. A ray-tracing model capable of determining the Sound Pressure Level (SPL) for a series of listening positions in front of both discrete (mesh) and continuous (NURBS) complex surfaces was developed for the purpose of this comparison. The density of the discrete representation is increased in a series of steps to determine how many mesh faces are required to approximate the results obtained with a continuous representation.

[1]mendez@arch.ethz.ch
[2]louena.shtrepi@polito.it
[3]elena.badino@polito.it
[4]arianna.astolfi@polito.it