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Discussion

Comments on "The boundary point method for the calculation of exterior acoustic radiation" (by S.Y. Zhang and X.Z. Chen, *Journal of Sound and Vibration* 228(4) (1999) 761–772)

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This paper is fundamentally wrong. The major mistake is the replacement of Eq. (1) by (3). The authors intend to replace the acoustic field radiated by an arbitrary structure by that of a cube with uniform source distribution inside the real source surface. This substitution will be fine, provided that the source strength of the cube is determined first to yield the same acoustic field as that of the original structure. The solution to the radiated acoustic pressure from this volume distribution of source is well known [1]

$$p(\vec{x},\omega)=\iiint_v f(\vec{x}_0,\omega)G(\vec{x}|\vec{x}_0)\,\mathrm{d}x_0\,\mathrm{d}y_0\,\mathrm{d}z_0,$$

where $f(\vec{x}_0,\omega)$ is the source strength density function inside volume V and $G(\vec{x}|\vec{x}_0)$ is the free-space Green's function.

$$G(\vec{x}|\vec{x}_0)=\frac{\mathrm{e}^{\mathrm{i}kR}}{4\pi R},$$

where $R=|\vec{x}-\vec{x}_0|$ is the distance between the source and receiver.

In order to replace the real vibrating source by an equivalent source distribution of any shape, for example, a cube, one must determine the source strength that produces exactly the same acoustic field in the exterior region. However, the authors simply replaced the real acoustic field by this equivalent field without any justification, which is equivalent to saying that the source strength density function is unity $f(\vec{x}_0,\omega)\equiv 1$ for the cube. This treatment is wrong and will not work for an arbitrarily vibrating structure.

Reference

[1] P.M. Morse, K.U. Ingard, *Theoretical Acoustics*, McGraw-Hill, New York, 1968, pp. 321 (Chapter 7).

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