Numerical calculation of the mutual impedance between pistons in a plane wall

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Calculation of the mutual impedance between two plane pistons in an infinite plane baffle involves a fourfold integration over the areas of the two pistons. In general, all of these integrations must be done numerically. However, for simple piston shapes, a change of variable can reduce two of the integrations to triviality leaving only two to be computed numerically. Results are presented for half-wavelength-diameter circular pistons and half-wavelength-dimension square pistons.

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Given two pistons in an infinite plane baffle, their mutual impedance is given by

$$Z_{mn}=\frac{j\rho ck}{2\pi}\int\int_m dx\,dy\int\int_n dx_0\,dy$$

$$\times\frac{\exp\{-jk[(X+x-x_0)^2+(Y+y-y_0)^2]^{1/2}\}}{[(X+x-x_0)^2+(Y+y-y_0)^2]^{1/2}}, \qquad (1)$$

where the coordinate systems are as shown in Fig. 1, and X and Y are the separations of the pistons along the axes. At this point the shape of each piston is arbitrary. For two of the integrations, we can change to the variables $u=x-x_0$ and $v=y-y_0$. This leaves

$$Z_{mn}=\frac{j\rho ck}{2\pi}\int du\int dv$$

$$\times\frac{\exp\{-jk[(X+u)^2+(Y+v)^2]^{1/2}\}}{[(X+u)^2+(Y+v)^2]^{1/2}}\int dx\int dy, \qquad (2)$$

where the limits of integration are chosen for the piston shapes desired. (The x and y integrations now do not extend over the entire area of either piston.)

For simple piston geometries, the x and y integrations can be done in closed form. Consider, for example, the case of two identical square pistons whose sides are respectively parallel and of length a, as shown in Fig. 1. The x and y integrations are done holding u, v, and X and Y constant. Referring to Fig. 1, these integrations give the area swept out by the segment AB as it is moved parallel to itself in such a way that each end remains on the surface of a piston. This is the shaded area in the figure.

Thus we have

$$Z_{mn}=\frac{j\rho ck}{2\pi}\int_{-a}^{a}du\int_{-a}^{a}dv(a-|u|)(a-|v|)$$

$$\times\frac{\exp\{-jk[(X+u)^2+(Y+v)^2]^{1/2}\}}{[(X+u)^2+(Y+v)^2]^{1/2}} \qquad (3)$$

as the integral to be computed numerically for the mutual impedance. Figure 2 shows the real and imaginary parts of this expression for half-wavelength-dimension pistons whose separation is parallel to one of their sides as a function of the separation. The calculation has been continued to zero separation, even though separations less than a half-wavelength are not physical, to show that the method gives the correct limiting value for the self-impedance.[1] The method has also

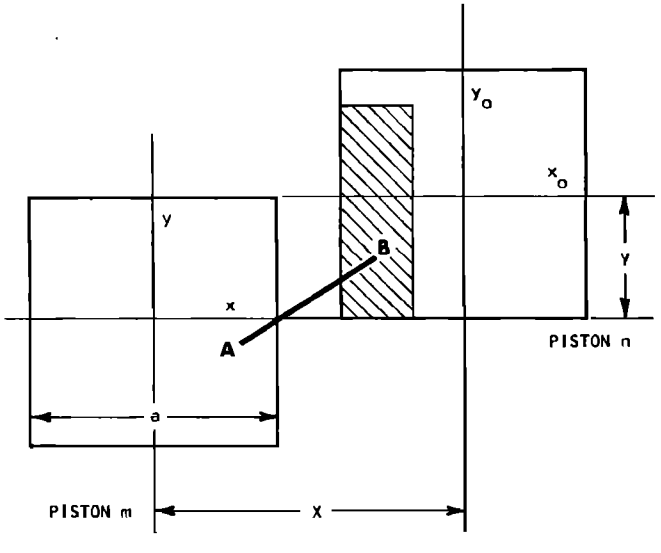

FIG. 1. Coordinate system used for the calculation.

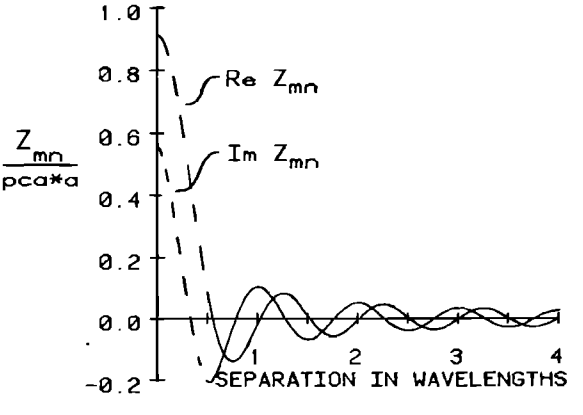

FIG. 2. Normalized mutual impedance ($Z_{mn}/\rho ca^2$) between two half-wavelength-dimension square pistons as a function of separation between piston centers. The two pistons have their sides respectively parallel and separation is parallel to one of the sides. (Separations less than a half-wavelength are not physical.)

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been used to calculate the mutual impedance between two circular disks. The results agree with the closed form expression for this case.[2]

[1]G. W. Swenson, Jr., and W. E. Johnson, J. Acoust. Soc. Am. 24, 84(L) (1952).
[2]R. L. Pritchard, J. Acoust. Soc. Am. 32, 730 (1960).

Communicating through poster sessions[a)]

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The poster session as a means of communication at scientific society meetings is described, with emphasis on both strong and weak points. Advice is given presenters and attendees for the most effective use of such sessions.

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INTRODUCTION

Most Acoustical Society members are familiar with platform oratory as a form of communication of impersonal information. "Oratory" has an antique ring, and hardly anyone today would admit to being an orator. Unlike the great orators of the past, today's platform speaker who wishes to inform rather than exhort generally uses notes—inconspicuously if possible—or simply reads a text if the occasion is regarded as especially important.

The speaker in a typical society meeting session may not truly want too much reaction. He or she is there to lay another pebble on the altar of knowledge and not to have pebbles flipped back. Besides, time usually permits only one or two often trivial questions before the next speaker comes on. Reaction to a paper may be limited because there is too wide a gap in understanding. The audience may be embarrassed because the speaker is too far ahead of them in lingo and concepts or because the speaker is too far behind them in knowing where the cutting edge lies.

Platform presentations will no doubt continue to provide a useful means of communication (while retaining valid formalistic and ceremonial status at conventions), but a rather stimulating alternative to platform oratory has been emerging in the society. It is the "poster session."

Poster sessions, which seem to have evolved from the ancient trade fair by way of the science fairs in the nation's schools in the late fifties, are being tried by the membership of quite a few eminent scientific and technical societies.

At a poster session, a more or less brief captivity is endured by the speakers—presenters might be a better term, but there is no captive audience. The audience strolls by the presenters as individual free agents with no commitments to feign or give attention unless really interested (except for the demands of courtesy to friends). When one is intrigued, one stops. What then ensues is not a speech but a chat, or at least it should be. A presenter who gives a speech either does not understand the format or has just proven resoundingly that a topic of such general interest to so many listeners should have been planned for the lecture hall instead of a poster session.

A chat requires continuous readjustment to the other person's frame of reference. Each person seeks common ground. Information washes back and forth, bathing speaker and listener as they swap roles with each sentence and utterance. Each learns, each teaches. The balance may run one way in one conversation and the opposite way in the next. That's great, but not perfect.

One trouble is that time passes at different rates for different participants. A half hour seems but a moment to a loquacious enthusiast who monopolizes the presenter while shyer folk, with more to give or more to absorb, move off rather than wait, interrupt, or appear to be eavesdropping.

A half hour is a long time when the presenters are on hand for perhaps one or two hours during the time allotted for their presentation. For the person who is encountering a wealth of eye openers, the time is cruelly short, just as it is cruelly long for the presenter who sits, then stands, and then sits again, trying to look bored in order to hide the humiliation and resentment that he or she feels because attention to the presented work and thought is being stolen by fellow presenters with a flair for showmanship.

I. ATTRACT ATTENTION

Showmanship is not necessarily all bad. Demosthenes never used slides in his talks, nor did the speakers at scientific sessions of the Royal Society when Sir Isaac Newton occupied the chair, but their use became quite respectable at a decent interval after showmen introduced the public to entertainment by magic lantern. Slides should, of course, stay respectable for serious communicators from the platform and earn respect for speakers who in turn respect the people who would dear-

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