ERRATA AND ADDITIONS FOR "ENGINEERING NOISE CONTROL"
4th Edn. Second printing
April 23, 2018

p24, Eq. 1.32 should not have the ± symbol on the RHS

p36, 3 lines from the bottom of the page, replace cos *b* with cos β

p68, In Equation (2.14), change *K* to *C*, where *C* is the viscous damping constant and define κ as the segment stiffness

p120, In Equation (3.29), remove the "−"sign following the "=" sign

p195, Equation (5.33) should be:

$$Q_0 = 4\pi a^2 \left[\frac{A}{a^2} + \frac{jkA}{a} \right] \mathrm{e}^{-jka} = 4\pi A (1 + jka)\, \mathrm{e}^{-jka} \tag{5.33a,b}$$

p196, Equation (5.36) should be:

$$p(\mathbf{r}, \theta, t) = \frac{jk\rho c Q_0}{(1 + jka)} [-G(r_1, h, \omega) + G(r_2, -h, \omega)]\, \mathrm{e}^{j(\omega t + ka)}$$

$$= \frac{jk\rho c Q_0}{(1 + jka)} \left[-G(r - h\cos\theta, h, \omega) + G(r + h\cos\theta, -h, \omega)\right] \mathrm{e}^{j(\omega t + ka)} \tag{5.36a,b}$$

p196 In Equations (5.37) and (5.38a), remove the minus sign that follows the equals sign

p197 In Equations (5.42), (5.43) and (5.44), remove the minus sign that follows the equals sign

p228, In Eq. 5.153, replace $2k_1$ with k

p228, In Eq. 5.153, replace (1-j) with (1+j)

p229, In Eq. 5.155, replace (1-j) with (1+j)

p229, Replace Equation (5.157) and the two lines preceding it with:
where $g(w)$ is the scaled complementary error function, erfc( ) is the complementary error function (Abramowitz and Stegun, 1965), and w, which is given by Equation (5.153), is a complex number.

The calculation of $g(w)$ is a complicated process and the equations to follow can only be used in isolation if the real part of w is less than 0 and the imaginary part is greater than 0 (that is, w is in the second quadrant of the complex plane). So any calculation begins with adjusting the value of w to w_a so that the real part is less than 0 and the imaginary part is greater than 0. As w_a is complex, we can write, $w_a = w_r + \mathrm{j}w_\mathrm{i} = \mathrm{Re}\{w_a\} + \mathrm{j}\ \mathrm{Im}\{w_a\}$. The calculation of $g(w_a)$ is undertaken using Equations (5.156) to

(5.159). If the original value of w did not need be adjusted to put w in the second quadrant of the complex plane, then $g(w) = g(w_a)$. If the original value of w before adjustment, was such that w was not in the second quadrant of the complex plane, then $g(w_a)$ must be adjusted to obtain $g(w)$, according to the following rules, with rule 1 applied first and rule 3 applied to the result after the application of rules 1 and 2.

1. If the imaginary part of w is less than 0, then $g(w_a)$ is replaced with $g(w) = 2\exp(-w_a^2) - g(w_a)$, where $g(w_a)$ is calculated using Equations (5.156) to (5.159);
2. If the imaginary part of w is greater than or equal to 0, then $g(w) = g(w_a)$;
3. If the product of the imaginary and real parts of w is greater than 0, then the sign of the imaginary part of $g(w_a)$ is changed (i.e., the complex conjugate of the $g(w)$ that was obtained using the preceding two rules is then the final $g(w)$).

For small w_r and w_i, where w_r is less than or equal to 3.9 and w_i is less than or equal to 3:

$$g(w_a) = g(w_r, jw_i) = K_1(w_i, w_r) + jK_2(w_i, w_r) \tag{5.157a}$$

where,

$$K_1(w_i, w_r) = \frac{hw_i}{\pi(w_r^2+w_i^2)} + \left[\frac{2w_i h}{\pi}\sum_{n=1}^{\infty}\frac{e^{-n^2h^2}(w_r^2+w_i^2+n^2h^2)}{(w_i^2-w_r^2+n^2h^2)^2+4w_r^2w_i^2}\right] - \frac{w_i}{\pi}E(h) \tag{5.157b}$$
$$\begin{array}{ll} +P & \text{if } w_i<\pi/h \\ +0.5P & \text{if } w_i = \pi/h \\ +0 & \text{if } w_i>\pi/h \end{array}$$

$$K_2(w_i, w_r) = \frac{hw_r}{\pi(w_r^2+w_i^2)} + \left[\frac{2w_r h}{\pi}\sum_{n=1}^{\infty}\frac{e^{-n^2h^2}(w_r^2+w_i^2+n^2h^2)}{(w_i^2-w_r^2+n^2h^2)^2+4w_r^2w_i^2}\right] + \frac{w_r}{\pi}E(h) \tag{5.157c}$$
$$\begin{array}{ll} -F & \text{if } w_i<\pi/h \\ -0.5F & \text{if } w_i = \pi/h \\ -0 & \text{if } w_i>\pi/h \end{array}$$

and where

$$P = \frac{2}{\exp[w_r^2 + (2w_i\pi/h) - w_i^2]}\left[\frac{(A_1C_1 - B_1D_1)}{(C_1^2 + D_1^2)}\right] \tag{5.157d}$$

$$F = \frac{2}{\exp[w_r^2 + (2w_i\pi/h) - w_i^2]}\left[\frac{(A_1D_1 + B_1C_1)}{(C_1^2 + D_1^2)}\right] \tag{5.157e}$$

$$\begin{cases} A_1 = \cos(2w_r w_i) \\ B_1 = \sin(2w_r w_i) \\ C_1 = \mathrm{e}^{-2w_i\pi/h} - \cos(2w_r\pi/h) \\ D_1 = \sin(2w_r\pi/h) \end{cases} \tag{5.157f}$$

The error bound can be estimated from:

$$E(h) \le \frac{2\sqrt{\pi}\,\mathrm{e}^{-(\pi^2/h^2)}}{\left(1 - \mathrm{e}^{-(\pi^2/h^2)}\right)} \tag{5.157g}$$

Note that h is a constant selected by the user. If h=1, then $E(h) \le 2\times10^{-4}$ and only 3 or 4 terms are needed in the infinite sums included in the expressions for K_1 and K_2. If h is reduced to 0.8, then $E(h) \le 10^{-6}$ and 5 terms will be needed in the infinite sums included in the expressions for K_1 and K_2. If h is reduced to 0.5, then $E(h) \le 10^{-15}$ and 14 terms will be needed in the infinite sums included in the expressions for K_1 and K_2. It is recommended that h = 0.8 be used.

p229, In Equations (5.158) and (5.159), replace $-jw$ with $+jw_a$ and replace w with w_a.

p229, 1 and 2 lines above Equation (5.158), replace 3 with 3.9 and 2 with 3.

p230, In Eq. 5.166, replace $2k$ with k

p230, In Eq. 5.166, replace (1-j) with (1+j)

p231, Replace the paragraph beginning with "The effect of turbulence" (including Equation (5.167) and the 3 lines following it) with the following:

The effect of atmospheric turbulence on sound over an acoustically smooth surface has been investigated by Clifford (1983) and by Raspet (1995). The presence or absence of turbulence may be included by a generalisation of their results to give the following general expression for the mean square sound pressure at a receiver located at a direct distance, r, from the source for a spherically symmetric sound source having unit far field sound pressure at 1 m:

$$\langle p^2 \rangle_t = \frac{1}{r^2} + \frac{|R_s|^2}{(r_1 + r_2)^2} + \frac{2|R_s|}{r(r_1 + r_2)} T\cos[\alpha_s - k(r_1 + r_2 - r)] \qquad (\mathrm{Pa}^2)$$

where: $\alpha_s = \tan^{-1}\dfrac{\mathrm{Im}\{R_s\}}{\mathrm{Re}\{R_s\}}$

and where the sign of k has been changed here to reflect that positive time dependence is used in this book, whereas negative time dependence has been used by Clifford (1983) and by Raspet (1995).

p247, Replace Equation (5.195) with:

$$A_g = -10\log_{10}\left[1 + \left(\frac{r}{r_1+r_2}\right)^2 |R_s|^2 + \left(\frac{2r}{r_1+r_2}\right)|R_s|\,T\cos\left[\alpha_s - k(r_1+r_2-r)\right]\right] \qquad \text{(dB)}$$

p248, 4 lines under Equation (5.197), Z_s should be Z_m

p255, Table 5.9, column 2, change the heading from “slight” to “strong” and change the bottom entry from “D” to “C”.

p255, Table 5.9, column 4, change the heading from “strong” to “slight”

p255, Table 5.9, Footnote *a*, change “close to ground” to “10 m above the ground”

p258, 4 lines above Eq. 5.206, change “added” to “subtracted”

p274-6, the standards ISO 3743/2, ISO 3747 and ISO 3741 are not listed at the end of the book. The references are:

ISO 3741:2010, “Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Precision methods for reverberation test rooms.”

ISO 3743-1:2010, “Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering methods for small movable sources in reverberant fields - Part 1: Comparison method for a hard-walled test room.”
ISO 3743-2:1994, “Acoustics - Determination of sound power levels of noise sources using sound pressure - Engineering methods for small, movable sources in reverberant fields - Part 2: Methods for special reverberation test rooms.”

ISO 3747:2010, “Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure - Engineering/survey methods for use in situ in a reverberant environment.”

p293, Equation (7.6), k^2 should be k_z^2

p364, 7 lines from the top of the page add “curvature of” immediately before “500"

p367, In Equation (8.24), the last term in brackets should be multiplied by 2.

p378, line 2, replace “8.39" with “8.38"

p404, Line 3 of item 2 in the solution, change “27.1" to “33.7"

p413, 3 lines below Eq. (8.103), the reference to Eq (8.100) should be Eq. (8.101).

p422, Item 3, “$N = (2/\ell)(2.5)$” should be “$N = (2/\lambda)(2.5)$”

p422, Add the following to the end of item 3, “As there are 3 diffracted paths around the building for sound arriving at the rear wall, the power level on the rear wall should be increased by $10\log_{10}(3)$=4.8 dB, so the total power on the rear wall becomes 71.8 dB."

p423, Line 2, change 67 to 71.8 and change 79 to 80.

p423, Line 4, change 80 to 81

p423, first equation, change 80 to 81 and change 74 to 75

p449, Replace Equation (9.44) with the following equation, where S_V is the cross sectional area of the volume.

$$\omega_0 = c\sqrt{-\frac{3\ell_e S_V + \ell_V S}{2\ell_e^3 S_V} + \sqrt{\left(\frac{3\ell_e S_V + \ell_V S}{2\ell_e^3 S_V}\right)^2 + \frac{3S}{\ell_e^3 S_V \ell_V}}}$$

p454, Last term in Equation (9.65), replace A_T with (A_T/Z_s)

p471, 2nd and 5th lines from the top, change "undamping" to "nonlinear"

p473, In Eq. (9.124), the right hand side should be multiplied by the gas density.

p477, Top label in Figure 9.14, change "quadruple" to "quadrupole".

p478, Line 8 under heading 9.8, change "undamping" to "non-linear".

p482, line 21, change "height" to "width".

p490, bottom line, $2h/\ell$ should be $2h/\lambda$

p494, Figure 9.23 caption should have the following sentence added. "Note that for a silencer with multiple baffles, S is the cross-sectional area of one airway, not the total silencer."

p497, 2 lines from the bottom of the page, change "doubled" to "double"

p498, 4th line under Section 9.11, change "9.5" to "9.6"

p506, replace second sentence under the heading, "9.15 DIRECTIVITY OF EXHAUST DUCTS" with "To get the rectangular section data to collapse on to the ka axis for circular ducts, where $2a$ is the duct diameter, it was necessary to multiply the rectangular duct dimension ($2d$) in the direction of the observer by $4/\pi$ to get $2a$.

p585, Line following Equation (11.55), replace "A-weighted internal level" with "unweighted internal level".

p586, Line following Equation (11.59), replace "A-weighted internal level" with "unweighted internal level".

p508, This page should be replaced with the following page.

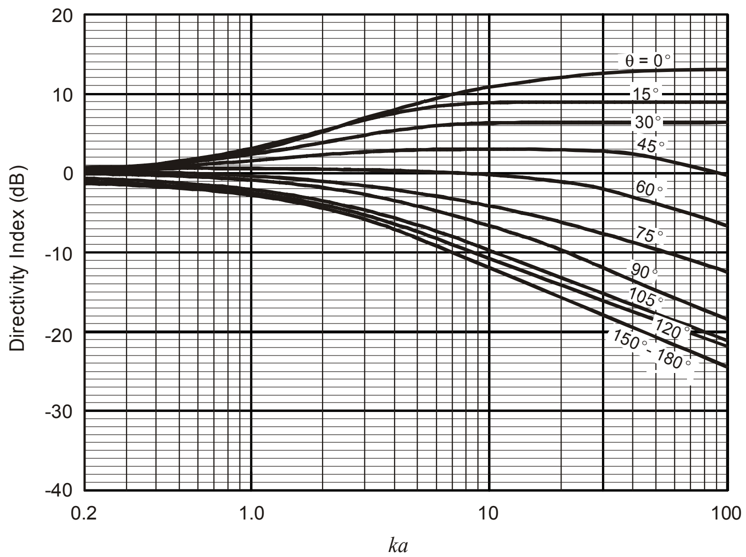

Figure 9.30. Exhaust stack directivity index measured in the field vs *ka* where *a* is the stack radius. Curves fitted to data reported by Day and Bennett (2008).

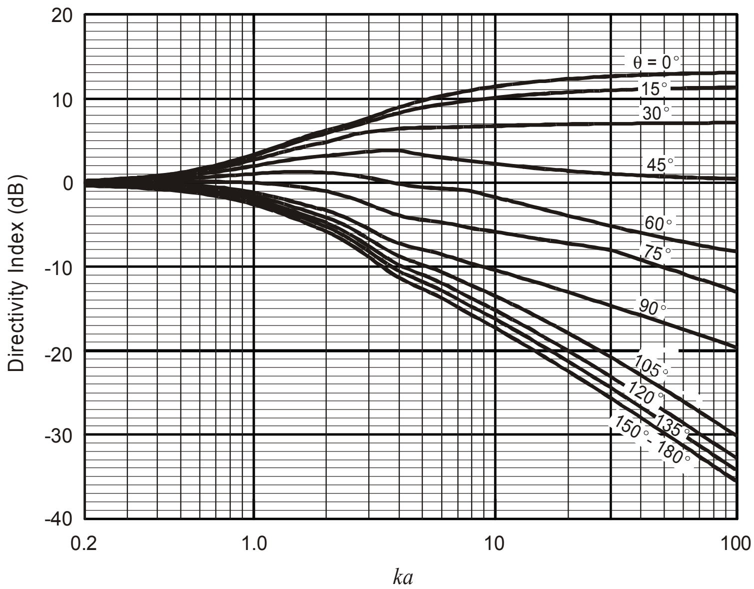

Figure 9.31 Exhaust stack directivity calculated using Davy's theory (2008a,b) for a $2a$ = 605 mm diameter duct. The curves do not change significantly with duct radius.

p509, first line, change 2π to π

p510, Equation (5.170) should be:

$$w(\varphi) = \left(\frac{\sin(ks_d \sin(\varphi))}{ks_d \sin(\varphi)}\right)^2 (1 - \alpha_{st})^{(L/2d)\tan|\varphi|}$$

p519, Equation (10.11) should be

$$k = \frac{d^4 \cos\alpha}{8 n_C D^3} \left[\frac{\cos^2\alpha}{G} + \frac{2\sin^2\alpha}{E} \right]^{-1}$$

p528, 5 lines above Equation (10.36), change "Equation (10.10)" to "Equation (10.12)"

p531, Equation (10.45) should be:

$$M_f = j(k_f/\omega - \omega m_f)^{-1}$$

p536, 6 lines under the figure, change "undamping" to "nonlinear"

p539, If damping, ζ_1, of the main mass is included, Equation (10.53) becomes:

$$|y_1| = \frac{|F|}{k_1}\left[\left(1 - \Omega^2 - r/q\right)^2 + \left(2\zeta_1\Omega + s/q\right)^2\right]^{-1/2}$$

and

$$|y_2| = |y_1|\left[(a/q)^2 + (b/q)^2\right]^{1/2}$$

where, $\Omega = \omega\sqrt{m_1/k_1}$, θ_1 and θ_2 are phase angles of the motion of the masses relative to the excitation force, $|F|$ is the amplitude of the excitation force and:

$$\begin{aligned}
a &= (k_2/k_1)^2 + 4\zeta_2^2\Omega^2 - (m_2/m_1)(k_2/k_1)\Omega^2 \\
b &= -2\zeta_2(m_2/m_1)\Omega^3 \\
q &= \left(\frac{k_2}{k_1} - \frac{m_2\Omega^2}{m_1}\right)^2 + 4\zeta_2^2\Omega^2 \\
r &= (m_2/m_1)(k_2/k_1)^2\Omega^2 - (m_2/m_1)^2(k_2/k_1)\Omega^4 + 4\zeta_2^2(m_2/m_1)\Omega^4 \\
s &= 2\zeta_2(m_2/m_1)^2\Omega^5
\end{aligned}$$

p572, Figure 11.3 caption, although Heitner did use a similar figure to this, it was based on the earlier work published by Ingard so the correct reference should be "Ingard, 1959".

p643, In Equation (12.36), change ψ to φ

p644, In Equation (12.40), change φ to ψ

p644, In Equation (12.40) and in the text in 3 places following the equation, change (x_b, y_b) to (x_b, y_b, z_b)

p644, 2 lines below Equation (12.40), change φ to ψ

p652, Third line of footnote, ρ should be ρ_m

p669, 4 lines above Eq. C1, change “undamping” to “nonlinear”

p669, Equation C.1 could be written in a less ambiguous way as

$$R_1 = \rho \Delta PA/(\dot{m}\ell) = \Delta PA/(V_0\ell)$$

p673, Two lines above Eq. C.9 (and 2 and 3 lines from the top of the page), replace “complex density” with “complex density (normalised with respect to the density of of the gas in the porous material)”.

p673, One and two lines above Eq. C.9 (and 3 lines from the top of the page), replace “complex compressibility” with “complex compressibility (normalised with respect to the compressibility of the gas in the porous material)”.

p686 3 lines under Equation (C.55), change “9.22” to “9.25”