## Nondestructive Jesting Handbook Edition

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Published by the American Society for Nondestructive Testing

PRINTED IN THE UNITED STATES OF AMERICA

Location	Item	Change to
Page 167, Eq. 16	$\partial P_T = 4 k P_L (RS)^{\frac{1}{2}} \partial z_1$	$\delta P_T = \frac{\partial P_T}{\partial z_1} \delta z_1 = 4k P_L \left(RS\right)^{1/2} \delta z_1$
Page 167, Eq. 17	$\frac{\partial P_T}{\Delta P_{T \max}} = k \partial z_1 = \frac{V_{\text{sig}}}{V_{\text{cal}}}$	$\frac{\delta P_T}{\Delta P_{T_{\text{max}}}} = k \delta z_1 = \frac{V_{\text{sig}}}{V_{\text{cal}}}$
Page 167, Eq. 18	$\partial z_1 = \delta I = \frac{\lambda}{2\pi} \frac{V_{\text{sig}}}{V_{\text{cal}}} = 100.7 \frac{V_{\text{sig}}}{V_{\text{cal}}} \text{ nm}$	$\delta z_1 = \delta I = \frac{\lambda}{2\pi} \frac{V_{\text{sig}}}{V_{\text{cal}}} = 100.7 \frac{V_{\text{sig}}}{V_{\text{cal}}} \text{ nm}$
Page 168, Eq. 20	$i_{\rm sig} = \alpha \partial P_T = 4 \alpha k (RS)^{\frac{1}{2}} P_L \partial z_1$	$i_{\rm sig} = \alpha \delta P_T = 4\alpha k (RS)^{\frac{1}{2}} P_L \delta z_1$
Page 168, Eq. 21, first line	$i_{\text{sig}} = 4\alpha k (RS)^{\frac{1}{2}} P_L \partial z_1$ $= \left[ 2qB\alpha (R+S)P_L \right]^{\frac{1}{2}} = i_n$	$i_{\text{sig}} = 4\alpha k (RS)^{\frac{1}{2}} P_L \delta z_1$ $= \left[ 2qB\alpha (R+S)P_L \right]^{\frac{1}{2}} = i_n$
Page 168, Eq. 22, first line	$\partial z_1 = \delta l_{\min} = \left(\frac{2qB}{\alpha P_L}\right)^{\frac{1}{2}} \frac{1}{k\sqrt{2}\sqrt{2}}$ $= \left(\frac{2qB}{\alpha P_L}\right)^{\frac{1}{2}} \frac{\lambda}{\pi 2\sqrt{2}}$	$\delta z_1 = \delta I_{\min} = \left(\frac{2qB}{\alpha P_L}\right)^{\frac{1}{2}} \frac{1}{k\sqrt{2}}$ $= \left(\frac{2qB}{\alpha P_L}\right)^{\frac{1}{2}} \frac{\lambda}{\pi 2\sqrt{2}}$
Page 168, under Eq. 22	So $\partial z_1 = 6.4 \times 10^{-12}$ m (2.5 × 10 <sup>-10</sup> in.) where: $q = 1.602 \times 10^{-19}$ coulomb; B = 10 MHz (electronic bandwidth); $P_L = 1$ mW; and a = 0.4 A/W radiation for silicon photodiode or = 632.8 nm (6,328 Å) for helium neon).	So $\delta z_1 = 6.4 \times 10^{-12}$ m (2.5 × 10 <sup>-10</sup> in.) where: $q = 1.602 \times 10^{-19}$ coulomb; B = 10 MHz (electronic bandwidth); $P_L = 1$ mW; $\alpha = 0.4$ A/W radiation for silicon photodiode; and $\lambda = 632.8$ nm (6,328 Å) for helium neon.
Page 169, column 1, line 6	techniques, <sup>12</sup> time delay interferometry and multiple beam velocity interferometry.	techniques, <sup>11</sup> time delay interferometry and multiple beam velocity interferometry.

Location	Item	Change to
Page 169, paragraph 2, lines 6 to 9	stress corrosion cracking in E4340 steel. <sup>13</sup> The trace in Fig. 9b was recorded at a point very close, about 1 mm (0.04 in.) from the growing crack; that in Fig. 9c, about 5 mm (0.2 in.) from the crack.	stress corrosion cracking in E4340 steel. <sup>6</sup> The trace in Fig. 9b was recorded at a point very close, about 1 mm (0.04 in.) from the growing crack; that in Fig. 9c, about 6.0 mm (0.24 in.) from the crack.
Page 169, column 1 five lines from bottom	another dual probe instrument <sup>14</sup> that has been used to accurately measure the speed of surface acoustic waves with an error of nearly 0.1 percent.	another dual probe instrument <sup>12</sup> that has been used to accurately measure the speed of surface acoustic waves with an error of nearly 0.1 percent.
Page 169, column 2 line 3	phase with with each other (rather than 180 degrees). <sup>15</sup>	phase with each other (rather than 180 degrees). <sup>13</sup>
Page 169, column 2, third line from bottom	implemented. <sup>16</sup> A modified version of this technique <sup>17</sup> uses electronic circuitry to select the best output channel and displays that output.	implemented. <sup>14</sup> A modified version of this technique <sup>15</sup> uses electronic circuitry to select the best output channel and displays that output.
Page 170, column 1 last line	technique. <sup>18,19</sup> In this technique, designed for continuous	technique. <sup>5</sup> In this technique, designed for continuous
Page 171, column 1, last paragraph, lines 6 to 9	glass block (Figs. 12a to 12c), as well as Lamb waves on a thin layer and Stoneley waves along the boundary of a ceramic-nickel interface. Figure 13 shows a recording of a Stoneley wave. <sup>20</sup>	glass block (Figs. 2a to 2c), as well as Lamb waves on a thin layer and Stoneley waves along the boundary of a ceramic-nickel interface. Figure 13 shows a recording of a Stoneley wave. <sup>17</sup>
Page 171, column 2, paragraph 2 line 3	conventional Ronchi clear/opaque grid. <sup>21</sup>	conventional Ronchi clear/opaque grid. <sup>18</sup>
Page 172, Eq. 26.	$I = \frac{E_{10}^2}{2} + \frac{E_{10}^2}{2}$	$I = \frac{E_{10}^2}{2} + \frac{E_{20}^2}{2}$
line 1	+ $(E_{10} E_{20}) \cos (2\pi f_B t + \Delta \psi)$	+ $(E_{10} E_{20}) \cos(2\pi f_B t + \Delta \psi)$
Page 172, column 2 second line from bottom	relatively slow moving), then $\Delta \psi = \Delta \phi(t) = 2k_p \delta I(t)$ .	relatively slow moving), then $\Delta \psi = \Delta \psi(t) = 2k_p \delta I(t)$ .

Location	Item	Change to
Page 173, P <sub>0</sub> Eq. 29,	$0 = 2(P_1P_2)^{\frac{1}{2}} \cos \left[ 2\pi f_B + 2k_p \delta I(t) \right]$	$P_0 = 2(P_1 P_2)^{\frac{1}{2}} \cos \left[ 2\pi f_B + 2k_p \delta l(t) \right]$
line 2	$= 2(P_1P_2)^{\frac{1}{2}} \cos \left[ \int_0^t \left( 2\pi f_B + \frac{4\pi f_p v(t)}{c} \right) \partial t \right]$	$= 2(P_1P_2)^{\frac{1}{2}} \cos \left[ \int_0^t \left( 2\pi f_B + \frac{4\pi f_p v(t)}{c} \right) dt \right]$
Page 173, Eq. 31	$i_{\rm sig} = aP_{\rm sig} = 2\alpha (2P_1P_2)^{\frac{1}{2}} k_p \delta I(t)$	$i_{\rm sig} = \alpha P_{\rm sig} = 2\alpha (2P_1P_2)^{\frac{1}{2}} k_p \delta I(t)$
Page 174, column 1, paragraph 3, lines 4 and 5	demodulation, <sup>22</sup> frequency tracking techniques, <sup>23,24</sup> the use of spectrum analyzers <sup>25</sup> or other techniques.	demodulation, <sup>19</sup> frequency tracking techniques, <sup>20,21</sup> the use of spectrum analyzers <sup>22</sup> or other techniques.
Page 174, Eq. 35, first line	$V = \frac{V_0 V_1}{2} \cos \left( 2\pi 2 f_B t - 2\pi 2 f_C t + \phi \right)$	$V = \frac{V_0 V_1}{2} \cos(2\pi 2 f_B t - 2\pi f_C t + \phi)$
	$+ \frac{1}{2} \cos\left(2\pi f_C t + \phi\right)$	$+ \frac{-1}{2}\cos(2\pi t_{c} t + \phi)$
Page 177, column 1, line 4	The final bandpass filter output is given in Eq. 33c:	The final bandpass filter output is given in Eq. 43:
Page 177, column 1, paragraph 2, line 3	detection as outlined in Fig. 22. <sup>30</sup>	detection as outlined in Fig. 22. <sup>22</sup>
Page 177, column 2, third line from bottom	shifted <sup>31</sup> with repect to the other. A second instrument, <sup>32</sup> also heterodyne, can measure both in-plane and normal (out-of-plane) displacements.	shifted <sup>27</sup> with repect to the other. A second instrument, <sup>26</sup> also heterodyne, can measure both in-plane and normal (out-of-plane) displacements.
Page 178, column 1, third line from bottom	being sent back to the beamsplitter as shown in Fig. 24. <sup>33</sup>	being sent back to the beamsplitter as shown in Fig. 24. <sup>28</sup>
Page 181, column 2, line 12	finesse degradation than they do in planar etalons. <sup>34</sup>	finesse degradation than they do in planar etalons. <sup>29</sup>

Location	Item	Change to
Page 181, column 2, paragraph 2, line 2	measure <sup>35</sup> ultrasonic wave induced surface displacements is shown in Fig. 29.	measure <sup>30</sup> ultrasonic wave induced surface displacements is shown in Fig. 29.
Page 182, column 2, paragraph 2, line 6	books. <sup>36,37</sup> As discussed above, optical techniques provide an	books. <sup>31,32</sup> As discussed above, optical techniques provide an
Page 183, column 1, paragraph 2, lines 10 and 11	doppler techniques, <sup>38</sup> measurement of the in-plane surface particle motion, <sup>39,40</sup> and measurement of out-of-plane (i.e. normal) components are useful for characterization of surface acoustic wave propagation.	doppler techniques, <sup>22</sup> measurement of the in-plane surface particle motion, <sup>26,27</sup> and measurement of out-of-plane (i.e. normal) components are useful for characterization of surface acoustic wave propagation.
Page 183, column 1 paragraph 3, line 13, and paragraph 4	material properties. <sup>41</sup> Figure 30 illustrates the appearance of a Lamb waveform in both a thin aluminum foil and a thin metallic glass sample as measured with a stabilized homodyne interferometer. <sup>42</sup>	material properties. <sup>33</sup> Figure 30 illustrates the appearance of a Lamb waveform in both a thin aluminum foil and a thin metallic glass sample as measured with a stabilized homodyne interferometer. <sup>34</sup>
Page 183, column 1, paragraph 5, last line, and last paragraph	previously. <sup>43</sup> Stoneley waves are acoustic waves that travel with little attenuation (like Rayleigh waves) between a suitable pair of materials for which the ratio of densities and the ratio of elastic constants fall within certain narrow ranges. <sup>44,45</sup>	previously. <sup>5,16</sup> Stoneley waves are acoustic waves that travel with little attenuation (like Rayleigh waves) between a suitable pair of materials for which the ratio of densities and the ratio of elastic constants fall within certain narrow ranges. <sup>17,35</sup>
Page 184, column 1, lines 2 and 7	in appropriate situations. <sup>46</sup> In a transparent medium the ultrasonic wave affects the optical density and thus changes the optical path length to produce detectable phase changes in the interferometer beams. Both homodyne and heterodyne interferometry can be useful here. Detailed theoretical treatment <sup>47</sup>	in appropriate situations. <sup>5</sup> In a transparent medium the ultrasonic wave affects the optical density and thus changes the optical path length to produce detectable phase changes in the interferometer beams. Both homodyne and heterodyne interferometry can be useful here. Detailed theoretical treatment <sup>36</sup>
Page 184, column 1, paragraph 3, line 2	corners <sup>48</sup> shows some of the possibilities.	corners <sup>10</sup> shows some of the possibilities.

## VOLUME 9: SPECIAL NONDESTRUCTIVE TESTING METHODS/7

Location	Item	Change to
Page 184, Eq. 55	$E = \rho c_s^2 \frac{3 c_l^2 - 4 c_s^2}{c_l^2}$	$E = \rho c_s^2 \frac{3 c_l^2 - 4 c_s^2}{c_l^2 - c_s^2}$
Page 185, column 1, paragraph 2, lines 12 to 14	for longitudinal wave arrival $t_c$ and shear wave arrival $t_s$ in steel (Fig. 32a) and a hard, porous composite material (Fig. 32b). <sup>49</sup>	for longitudinal wave arrival $t_i$ and shear wave arrival $t_s$ in steel (Fig. 32a) and a hard, porous composite material (Fig. 32b). <sup>37</sup>
Page 186, column 1, paragraph 1, lines 8 and 10	measurement of air flow velocities) $^{50}$ and the determination of the free surface velocity of impacted projectiles and explosive drive plates. $^{51}$	measurement of air flow velocities) <sup>38</sup> and the determination of the free surface velocity of impacted projectiles and explosive drive plates. <sup>39</sup>
Page 186, column 1, paragraph 2, line 3	etalon <sup>52</sup> with a bandwidth of approximately 13 MHz and	etalon <sup>30</sup> with a bandwidth of approximately 13 MHz and
Page 186, column 1, paragraph 3, line 2	the use of optical techniques becomes very advantageous. <sup>53</sup>	the use of optical techniques becomes very advantageous. <sup>6</sup>
Page 186, column 1, paragraph 3, line 9	temperatures ranging from room temperature to close to 1,000 °C (over 1,800 °F). $^{54}$	temperatures ranging from room temperature to close to 1,000 °C (over 1,800 °F). <sup>40</sup>
Page 186, column 1, paragraph 4, line 2	have been made by various researchers. One group <sup>55</sup> used	have been made by various researchers. One group <sup>26</sup> used
Page 186, column 1, paragraph 5, line 1	In one experiment <sup>56</sup> a neodymium–yttrium- aluminum-garnet laser was used	In one experiment <sup>41</sup> a neodymium–yttrium- aluminum-garnet laser was used
Page 186, column 2, paragraph 2, lines 12 and 13	configuration <sup>57</sup> or noninterferometric techniques such as the beam deflection technique. <sup>58</sup>	configuration <sup>42</sup> or noninterferometric techniques such as the beam deflection technique. <sup>43</sup>

Location	Item	Change to
Page 187, column 1, line 7	patterns of a piezoelectric disk suspended in air. <sup>59</sup>	patterns of a piezoelectric disk suspended in air. <sup>44</sup>
Page 187, column 1, paragraph 4, line 3 and 7	composite panels. <sup>60</sup> A <i>Q</i> -switched neodymium–yttrium-aluminum-garnet laser generated the ultrasonic waves on one side of the sample and a multiple wave interference detector was used on the other side to detect through-transmitted ultrasonic waves. The sample was a 150 ply, 15 mm (6.3 in.)	composite panels. <sup>45</sup> A <i>Q</i> -switched neodymium–yttrium–aluminumgarnet laser generated the ultrasonic waves on one side of the sample and a multiple wave interference detector was used on the other side to detect through- transmitted ultrasonic waves. The sample was a 150 ply, 15 mm (0.6 in.)
Page 187, column 2, paragraph 2, line 3	aluminum plate. <sup>61</sup>	aluminum plate. <sup>46</sup>
Page 188, column 2, paragraph 2, line 3	completely optical inspection system. <sup>62</sup>	completely optical inspection system. <sup>10</sup>
Page 188, column 2, paragraph 2, lines 11 and 12	interferometer <sup>63</sup> to detect frequency dependent Lamb wave scattering. Time domain reflectometry <sup>64</sup> has also been used to detect reflections from a Rayleigh wave incident on the slot.	interferometer <sup>47</sup> to detect frequency dependent Lamb wave scattering. Time domain reflectometry <sup>48</sup> has also been used to detect reflections from a Rayleigh wave incident on the slot.
Page 188, column 2, paragraph 3, line 4	used to induce surface fractures. <sup>65</sup>	used to induce surface fractures. <sup>10</sup>
Page 188, column 2, paragraph 4, line 19	source is scanned over the surface of the structure with the coating. <sup>66</sup>	source is scanned over the surface of the structure with the coating. <sup>44</sup>
Page 189, column 1, paragraph 3, line 3	a distance from the object. <sup>67</sup>	a distance from the object. <sup>50</sup>
Page 189, column 1, paragraph 3, line 9	interferometers <sup>68,69</sup> or two-wave time delay interferometers also have the same immunity to ambient vibrations.	interferometers <sup>30,45</sup> or two-wave time delay interferometers also have the same immunity to ambient vibrations.

Location	Item	Change to
Page 190, column 1, paragraph 2, line 2	for the calibration of transducers <sup>70</sup> images were formed of	for the calibration of transducers, <sup>51</sup> images were formed of
Page 190, column 1, paragraph 2, line 10	aluminum ranging in thickness from 5 to 20 mm (0.4 to 0.8 in.).	aluminum ranging in thickness from 5 to 20 mm (0.2 to 0.8 in.).
Page 192, Eq. 59	$\frac{\tan h\left\{\pi f d \sqrt{a[>3]}\right\}}{\tan h\left\{\pi f d \sqrt{\frac{V_L^2 - V^2}{V_L^2 V^2}}\right\}} = \frac{\left(2 - \frac{V^2}{V_S^2}\right)^2}{4\sqrt{\left(1 - \frac{V^2}{V_L^2}\right)\left(1 - \frac{V^2}{V_S^2}\right)}}$	$\frac{\tanh\left\{\pi fd\sqrt{a[>3]}\right\}}{\tanh\left\{\pi fd\sqrt{V_{L}^{2}-V^{2}}\right\}} = \frac{\left(2-\frac{V^{2}}{V_{S}^{2}}\right)^{2}}{4\sqrt{\left(1-\frac{V^{2}}{V_{L}^{2}}\right)\left(1-\frac{V^{2}}{V_{S}^{2}}\right)}}$
Page 192, column 2, line 4	Using the fact that $\tan h(ix) = \tan (x)/i$ , this	Using the fact that $tanh(ix) = i tan(x)$ , this
Page 193, column 2, paragraph 2, line 11	(8.3 $\times$ 10 $^{-5}$ in.) to 3.36 mm (0.13 in.), as shown in Table 1.	(8.3 $\times$ 10 $^{-4}$ in.) to 3.36 mm (0.13 in.), as shown in Table 1.
Page 194, column 1, paragraph 2, line 4	0.2 mg $[7 \times 10^{-5} \text{ oz}]$ silver acetelyde) was affixed to the free end of the delay rod.	0.2 mg [7 $\times$ 10 <sup>-6</sup> oz] silver acetelyde) was affixed to the free end of the delay rod.
Page 198, column 1, paragraph 3, line 4	29 $\mu s$ (1.14 $\times$ 10 $^{-3}$ in.) after excitation.	29 µs after excitation.
Page 198, column 1, paragraph 3, line 9	decreases $(n + 5 \rightarrow n = 1)$ , so too does the velocity of the wave.	decreases $(n = 5 \rightarrow n = 1)$ , so too does the velocity of the wave.

Location	Item	Change to
Page 201, Eq. 60	$\theta$ < arcsin $\sqrt{n^2 - n_1^2}$	$\theta$ < arcsin $\sqrt{n_1^2 - n_2^2}$
Page 204, Eqs. 66 and 67	$E_s = E_0 \cos(\omega t + \phi s)$	$E_s = E_0 \cos(\omega t + \phi_s)$
	$E_r = E_0 \cos \left( \omega t + \phi r \right)$	$E_r = E_0 \cos(\omega t + \phi_r)$
Page 204, column 1, paragraph 2, line 11	measurand than $\phi_{r^*}\Delta_\phi$ is a function of the measurand.	measurand than $\phi_{r^{*}}\Delta\phi$ is a function of the measurand.
Page 204, Eq. 70	$c = \frac{n^2}{2} \left[ (1 - v) p_{12} - v p_{12} \right]$	$c = \frac{n^2}{2} \left[ (1 - v) p_{12} - v p_{11} \right]$
Page 204, under Eq. 70	$P_{ij}$ = a component of strain-optic tensor characteristic of crystal class symmetry of material.	$p_{ij}$ = a component of strain-optic tensor characteristic of crystal class symmetry of material.
Page 205, column 1, paragraph 3, line 6	10 to 100 $\mu$ m (0.01 to 0.001 in.) fibers embedded into a matrix material (metal, ceramic or polymer) for reinforcement of the matrix.	10 to 100 $\mu m$ (4 $\times$ 10 <sup>-4</sup> to 4 $\times$ 10 <sup>-3</sup> in.) fibers embedded into a matrix material (metal, ceramic or polymer) for reinforcement of the matrix.
Page 206, column 1, paragraph 2, line 8	described by $E_0 \cos (\omega t + \phi_s)$ and $E_0 \cos (\omega t + \phi_s)$ are combined in a 2 × 2 single mode coupler and the output signal is detected by an optical detector, typically a PIN diode, an avalanche photo diode or a photomuliplier tube.	described by $E_0 \cos (\omega t + \phi_s)$ and $E_0 \cos (\omega t + \phi_s)$ are combined in a 2 × 2 single mode coupler and the output signal is detected by an optical detector, typically a PIN diode, an avalanche photo diode or a photomuliplier tube.
Page 207, column 2, paragraph 3, line 5	of a single mode optical fiber. The cavity if formed by the region	of a single mode optical fiber. The cavity is formed by the region

This errata booklet was compiled by the Publications Department of the American Society for Nondestructive Testing and contributors to Volume 9.



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