

Errata and Corrigenda for *Statistics for Chemical and Material Engineers: A Modern Approach*

Last Update: December 19th, 2019

Page, line	Current Form	Correction
p.8, Equation (1.19) and line before	σ_{mad}	$\hat{\sigma}_{rob}^1$
p. 34, 10	written as m_n ,	written as <u>m_i</u> ,
p. 35, last Equation	$f(x) = \frac{3}{8}x^3$	$f(x) = \frac{3}{8}x^2$ should be <i>squared</i> rather than <i>cubed</i> .
p. 37, Equation (2.13)	$E(x) = \int_{-\infty}^{\infty} xf(x)dx = \mu.$	$E(X) = \int_{-\infty}^{\infty} xf(x)dx = \mu.$

¹ This makes the symbols consistent and also emphasis that we are dealing with the robust estimate of the standard deviation.

Page, line	Current Form	Correction
p. 37, last equation of Example 2.4	$E(3XY) = 3E(XY)$ $= 3(E(X)E(Y) + \text{cov}(X, Y)) = 3((5)(2) - 2)$ $= 24$	$E(3XY) = 3E(XY)$ $= 3(E(X)E(Y) + \text{cov}(X, Y)) = 3((5)(2) + 2)$ $= 36$ <p>It should be “+2” rather than “-2” in the second line of the equation. As well, this will then change the final answer.</p>
p. 41 (last Equation on page)	$\mu_z = \int_0^{\infty} z f_z(z) dy = \int_0^{\infty} 4ze^{-4z} dy = 4 \times \frac{1}{16} = 0.25$	$\mu_z = \int_0^{\infty} z f_z(z) dy = \int_0^{\infty} 4ze^{-4z} dz = 4 \times \frac{1}{16} = 0.25^2$
p. 43, Section 4.2, line 6	Except for the last three distributions which are discrete	Except for the last two distributions which are discrete
p. 51, bullet #3	mean square error	mean squared error
p. 55, Equation (2.41)	$\ell(\theta \bar{x}) = \log L(\theta \bar{x}) = \sum_{i=1}^n f(x_i, \theta)$	$\ell(\theta \bar{x}) = \log L(\theta \bar{x}) = \sum_{i=1}^n \log f(x_i, \theta)$ <p>The log is missing from the summation.</p>

² dy should be replaced by dz .

Page, line	Current Form	Correction
p. 63, bullet #3, line 2	...for a small initial confidence intervals.	<i>remove these words.</i>
p. 64, line 12	...variance is known (in which it should be used in lieu of σ) or $n > 30$variance is known (in which case it should be used in lieu of σ) or $n > 30$.
p. 66, Example 2.10, Equation	$t_{computed} = \frac{1.56 - 1}{\frac{0.77}{\sqrt{7}}} = 1.92$	$t_{computed} = \frac{1.56 - 1}{\frac{0.78}{\sqrt{7}}} = 1.90$
p. 68, Example 2.13, line 5	...during 40 h of operation.	...during 50 h of operation.
p.73, lines 1/2	Example 2.15: Testing the Difference in Means— Unknown, Common Mean	Example 2.15: Testing the Difference in Means— Unknown, Common Variance
p. 77 (last line of the page)	(not centred)	(centred; The formula should be centred on the page.)
p. 80, bullet #13	mean square error	mean squared error
p. 81, Equation (2.68)	$x \geq 0$	$\underline{y} \geq 0$

Page, line	Current Form	Correction
p. 82, bullet #27	mean square error	mean squared error
p. 95 ff, Theorem 3.2 (bis)	Theorem 3.2: <i>Under the assumption</i>	Theorem 3.3: <i>Under the assumption</i> (and this implies that the numbering is one off for the rest of the theorems.)
p. 95, above Eq. (3.13)	The variance of the parameters can be written as	<u>From Equation (2.20)</u> , the variance of the parameters can be written as (clarifying how the variance is obtained)
p. 96, Equation (3.18)	$\sigma_{\hat{\beta}}^2 = E(\varepsilon\varepsilon^T) = \sigma^2 \mathcal{I}$	$\underline{\sigma}_{\varepsilon}^2 = E(\varepsilon\varepsilon^T) = \sigma^2 \mathcal{I}$
p. 96, Equation (3.20)	$\hat{\beta}_i \pm t_{n-m, 1-\frac{\alpha}{2}} \hat{\sigma} \sqrt{(\mathcal{A}^T \mathcal{A})_{ii}^{-1}}$	$\hat{\beta}_i \pm t_{1-\frac{\alpha}{2}, n-m} \hat{\sigma} \sqrt{(\mathcal{A}^T \mathcal{A})_{ii}^{-1}}$ (for consistency)
p. 106, line 4	$t_{0.975, 7-1} = 2.967$	$t_{0.975, 7-1} = 2.447$
p. 106, Equation (3.66)	$28.3529 \pm 2.9687 (0.310\ 43) \sqrt{0.714\ 28}$ $28.3529 \pm 0.7789 \frac{\text{kg}}{\text{min} \cdot \text{m}^{0.5}}$	$28.3529 \pm 2.447 (0.310\ 43) \sqrt{0.714\ 28}$ $28.3529 \pm 0.642 \frac{\text{kg}}{\text{min} \cdot \text{m}^{0.5}}$
p. 106, line 10	0.8	0.6

Page, line	Current Form	Correction
p. 106, line 11	$28.4 \pm 0.8 \text{ kg} \cdot \text{min}^{-1} \cdot \text{m}^{-0.5}$	$28.4 \pm 0.6 \text{ kg} \cdot \text{min}^{-1} \cdot \text{m}^{-0.5}$
p. 106, Equation (3.67)	$\bar{x}_0 \hat{\beta} \pm t_{1-\frac{\alpha}{2}, m-n} \hat{\sigma} \sqrt{\bar{x}_0 (\mathcal{A}^T \mathcal{A})^{-1} \bar{x}_0^T}$ $\sqrt{0.225} (28.3529) \pm$ $2.9687 (0.310 \ 43) \sqrt{\sqrt{0.225} (0.714 \ 28) \sqrt{0.225}}$ $13.448 \ 96 \pm 0.3694 \frac{\text{kg}}{\text{min}}$	$\bar{a}_{\bar{x}_d} \hat{\beta} \pm t_{1-\frac{\alpha}{2}, m-n} \hat{\sigma} \sqrt{\bar{a}_{\bar{x}_d} (\mathcal{A}^T \mathcal{A})^{-1} \bar{a}_{\bar{x}_d}^T}$ $\sqrt{0.225} (28.3529) \pm$ $2.447 (0.310 \ 43) \sqrt{\sqrt{0.225} (0.714 \ 28) \sqrt{0.225}}$ $13.448 \ 96 \pm 0.304 \frac{\text{kg}}{\text{min}}$
p. 106, line 14	$13.5 \pm 0.4 \text{ kg} \cdot \text{m}^{-1}$	$13.\underline{4} \pm 0.\underline{3} \text{ kg} \cdot \text{m}^{-1}$
p. 106, Equation (3.68)	$\bar{x}_0 \hat{\beta} \pm t_{1-\frac{\alpha}{2}, m-n} \hat{\sigma} \sqrt{1 + \bar{x}_0 (\mathcal{A}^T \mathcal{A})^{-1} \bar{x}_0^T}$ $\sqrt{0.225} (28.3529) \pm$ $2.9687 (0.310 \ 43) \sqrt{1 + \sqrt{0.225} (0.714 \ 28) \sqrt{0.225}}$ $13.448 \ 96 \pm 0.9929 \frac{\text{kg}}{\text{min}}$	$\bar{a}_{\bar{x}_d} \hat{\beta} \pm t_{1-\frac{\alpha}{2}, m-n} \hat{\sigma} \sqrt{1 + \bar{a}_{\bar{x}_d} (\mathcal{A}^T \mathcal{A})^{-1} \bar{a}_{\bar{x}_d}^T}$ $\sqrt{0.225} (28.3529) \pm$ $2.447 (0.310 \ 43) \sqrt{1 + \sqrt{0.225} (0.714 \ 28) \sqrt{0.225}}$ $13.448 \ 96 \pm 0.8184 \frac{\text{kg}}{\text{min}}$
p. 106, line 18	$14 \pm 1 \text{ kg} \cdot \text{m}^{-1}$	$1\underline{3} \pm \underline{0.8} \text{ kg} \cdot \text{m}^{-1}$
Table 3.2 (fifth cell)	Pronounced Tails	<u>Pronounced</u> Tails

Page, line	Current Form	Correction
p. 111, 17	the letters correspond to the graphs shown in Table 3.4 as problem graphs	<u>the letters correspond to the problem graphs shown in Table 3.4</u>
Table 3.4	plot(s)	<u>graph(s)</u>
p. 114, line 28	$\hat{R} = 28.4 \pm 0.8 \frac{\text{kg}}{\text{min} \cdot \text{m}^{0.5}}$	$\hat{R} = 28.4 \pm 0.6 \frac{\text{kg}}{\text{min} \cdot \text{m}^{0.5}}$
p. 119, Example 3.2	...(consider replicates 2 and 3 of run 2).	...(consider replicates 2 and 3 of Run 3).
p. 124, 2 nd line after Equation (3.108)	$\ln A = 5.70084 \pm 0.00762$ and $-E_d R^{-1} = -178.84 \pm 2.20878$	$\ln A = 5.70084 \pm 0.00653$ and $-E_d R^{-1} = -178.84 \pm 1.89351$
p. 124, 2 nd paragraph after Equation (3.108)	This gives $\hat{A}_{lower} = e^{5.70084 - 0.00762} = 296.8$ and $\hat{A}_{lower} = e^{5.70084 + 0.00762} = 301.41$.	This gives $\hat{A}_{lower} = e^{5.70084 - 0.00653} = 297.2$ and $\hat{A}_{upper} = e^{5.70084 + 0.00653} = 301.08$.

Page, line	Current Form	Correction
p. 124, 3 rd paragraph after Equation (3.108)	The confidence interval becomes $2.208\ 78 \times -8.314 = (-)18.36$. Therefore, the confidence interval for E_a is $1,490 \pm 18\ \text{J} \cdot \text{mol}^{-1}$.	The confidence interval becomes $1.893\ 51 \times -8.314 = (-)15.74$. Therefore, the confidence interval for E_a is $1,490 \pm 16\ \text{J} \cdot \text{mol}^{-1}$.
p. 125, 2 nd line	$\hat{E}_a = 1,490 \pm 21\ \text{J} \cdot \text{mol}^{-1}$	$\hat{E}_a = 1,490 \pm 18\ \text{J} \cdot \text{mol}^{-1}$
p. 125, Figure 3.4 (bottom, left)		<i>see Appendix I: Correction to Figure 3.4 (bottom, left) for the correct figure.</i>
p. 125, starting from the second line after Equation (3.110)	Secondly, Fig. 3.4 show normal probability plots... This shows the importance of selecting an appropriate method for the given problem.	<i>see Appendix I: Correction to Figure 3.4 (bottom, left) for the corrected text.</i>
p. 131, 3	The confidence interval for $T = 105^\circ\text{F}$ is more reliable	The <u>prediction</u> for $T = 105^\circ\text{F}$ is more reliable

Page, line	Current Form	Correction
p. 138, Equation (3.A7)	$\hat{y} \pm t_{1-\frac{\alpha}{2}, m-2} \hat{\sigma} \sqrt{\frac{1}{m} + \frac{\left(x_d - \frac{1}{m} \sum x_i\right)^2}{s_x^2}}$	$\hat{y} \pm t_{1-\frac{\alpha}{2}, m-2} \hat{\sigma} \sqrt{\frac{1}{m} + \frac{\left(x_d - \frac{1}{m} \sum x\right)^2}{s_x^2}}$
p. 138, Equation (3.A8)	$\hat{y} \pm t_{1-\frac{\alpha}{2}, m-2} \hat{\sigma} \sqrt{1 + \frac{1}{m} + \frac{\left(x_d - \frac{1}{m} \sum x_i\right)^2}{s_x^2}}$	$\hat{y} \pm t_{1-\frac{\alpha}{2}, m-2} \hat{\sigma} \sqrt{1 + \frac{1}{m} + \frac{\left(x_d - \frac{1}{m} \sum x\right)^2}{s_x^2}}$
p. 139, Section A.2	The ordinary, least-squares problem can be solved by first computing the following two quantities	The weighted , least-squares problem can be solved by first computing the following two quantities
p. 139, Equation (3.A18)	$\hat{y} \pm t_{1-\frac{\alpha}{2}, m-2} \hat{\sigma}_w \sqrt{\frac{1}{\left(\sum w_i\right)} + \frac{\left(x_d - \frac{1}{\left(\sum w_i\right)} \sum w_i x_i\right)^2}{s_{x_w}^2}}$	$\hat{y} \pm t_{1-\frac{\alpha}{2}, m-2} \hat{\sigma}_w \sqrt{\frac{1}{\left(\sum w\right)} + \frac{\left(x_d - \frac{1}{\left(\sum w\right)} \sum wx\right)^2}{s_{x_w}^2}}$
p. 139, Equation (3.A19)	$\hat{y} \pm t_{1-\frac{\alpha}{2}, m-2-n'} \hat{\sigma}_w \sqrt{\frac{1}{w_d} + \frac{1}{\left(\sum w_i\right)} + \frac{\left(x_d - \frac{1}{\left(\sum w_i\right)} \sum w_i x_i\right)^2}{s_x^2}}$	$\hat{y} \pm t_{1-\frac{\alpha}{2}, m-2-n'} \hat{\sigma}_w \sqrt{\frac{1}{w_d} + \frac{1}{\left(\sum w\right)} + \frac{\left(x_d - \frac{1}{\left(\sum w\right)} \sum wx\right)^2}{s_x^2}}$
p. 142, Equation (4.1)	$S_{\beta_i} = \frac{\partial \bar{f}(\bar{x}, \bar{\beta})}{\partial \beta_i}$	$\bar{S}_{\beta_i} = \frac{\partial \bar{f}(\bar{x}, \bar{\beta})}{\partial \beta_i}$ <p>(for consistency)</p>

Page, line	Current Form	Correction
p. 156, first two lines	see footnote ³	see footnote ⁴ The equations are too large to show otherwise and all entries are wrong.
p. 156f, Example 4.2, b), c), and d)	<i>Some of the comments for question b), c), and d) are not correct given the error in the computation of the parameter values.</i>	<i>Please see Appendix I: Correction for Example 4.2 for the updated version.</i>
p. 159, §4.5.3.1, first sentence of paragraph 3	where x is the divisor and y is the dividend (or base)	where x is the dividend and y is the divisor (or base)

$$\hat{\beta} = 2^{-4} \mathcal{A}^T \bar{y}$$

$$^3 = \begin{bmatrix} 101 & 5.19 & -0.813 & -2.19 & 3.06 & -0.0625 & -7.69 & -0.438 & 0.813 & 0.813 & \dots \\ & & & \dots & & -0.313 & 0.313 & -0.188 & -0.0625 & 0.188 & -0.313 \end{bmatrix}^T \text{ (original)}$$

$$\hat{\beta} = 2^{-4} \mathcal{A}^T \bar{y}$$

$$^4 = \begin{bmatrix} 70.06 & 10.81 & 1.56 & 4.94 & 7.31 & 0.0625 & -9.06 & 8.31 & 1.19 & -0.188 & \dots \\ & & & \dots & & -0.563 & 0.938 & 2.063 & -0.813 & -1.32 & 0.688 \end{bmatrix}^T \text{ (corrected)}$$

Page, line	Current Form	Correction
p. 161f, §4.5.3.4	n	k (replace all n in this section by k , the number of factors)
p. 162, line 28	Since n is odd...	Since $k = 5$ and is odd... (to clarify the situation!)
p. 171, lines 5/6	Using the F -test approach to determining the significant parameters, find a reduced model and analyse its residuals.	Using the F -test approach to determining the significant parameters, find a reduced model and analyse its residuals <u>($\alpha = 0.05$).</u>
p. 173, Table 4.4	F -critical, model F -test	F -critical, model $F_{0.95, 15, 16}$ F -test, model F -critical, parameter $F_{0.95, 1, 16}$ 4.49 (<i>added</i>)
p. 174, Example 4.9, line 4	63%	67% (It should be $100 \times R^2$.)
p. 174, Example 4.9, Table 4.5		F_i for β_{15} and β_{35} should be bolded, as they are significant.
p. 174, Example 4.9, Table 4.5	F -critical, model F -test	F -critical, model $F_{0.95, 1, 30}$ F -test, model

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p. 175, Example 4.9, Figure 4.6 (bottom)		<p><i>see Appendix III: Correction for Example 4.9, Figure 4.6 (bottom).</i></p> <p>(The figure has been updated to have properly labelled axes. There are no overall changes in the figures.)</p>
p. 175, Example 4.9, Figure 4.7		<p><i>see Appendix IV: Correction for Example 4.9, Figure 4.7.</i></p> <p>(The figures have been updated to make clear that the correct reduced model was used. There are no overall changes in the figures.)</p>
p. 175, line 4	is now 0.91	is now <u>0.88</u>
p. 180, Equation (4.39)	$\gamma_{ji} = \sum_{k=0}^{\frac{j}{2}} \beta_{jk} x_i^k$	$\gamma_{ji} = \sum_{k=0}^{\frac{j}{2}} \beta_{jk} x_i^{2k}$ <p>The superscript on the x should be 2k rather than k.</p>
p. 182, line 6 (right after Eq. 4.51)	$\gamma_{11} + \gamma_{12} + \gamma_{13} = 0$	$\gamma_{21} + \gamma_{22} + \gamma_{23} = 0$

Page, line	Current Form	Correction
p. 182, line 7 (right after Eq. 4.51)	(6 unknowns, but 5 equations)	<u>(5</u> unknowns, but <u>4</u> equations)
p. 182, line 8 (right before Eq. 4.52)	$\gamma_{13} = \gamma_{11} = 1$	$\gamma_{23} = \gamma_{21} = 1$
p. 184, Equation (4.55), 4 th line	$\gamma_{13} = \beta_{11}x_4 = \beta_{11}(1)$	$\gamma_{14} = \beta_{11}x_4 = \beta_{11}(1)$ It should be γ_{14} rather than γ_{13} .
p. 184, Equation (4.56)	$\gamma_{11} = -1, \gamma_{12} = -\frac{1}{3}, \gamma_{13} = \frac{1}{3}, \gamma_{14} = 1$ $\beta_{11} = 1$	$\gamma_{11} = -1, \gamma_{12} = -\frac{1}{3}, \gamma_{13} = \frac{1}{3}, \gamma_{14} = 1$ $\beta_{11} = 1$ The second γ_{12} should read as γ_{13} and the γ_{13} as γ_{14} .
p. 185, line 7 (right after Eq. 4.61)	$\gamma_{11} + \gamma_{12} + \gamma_{13} + \gamma_{14} = 0$	$\gamma_{21} + \gamma_{22} + \gamma_{23} + \gamma_{24} = 0$

Page, line	Current Form	Correction
p. 185, line 8 (right after Eq. 4.61)	$\gamma_{13} = \gamma_{12}$ and $\gamma_{14} = \gamma_{11}$	$\gamma_{23} = \gamma_{22}$ and $\gamma_{24} = \gamma_{21}$
p. 185, line 9 (right before Eq. 4.62)	$\gamma_{13} = \gamma_{12} = -1$	$\gamma_{23} = \gamma_{21} = -1$
p. 185, line 14 (right after Eq. 4.63)	$\gamma_{11} + \gamma_{12} + \gamma_{13} + \gamma_{14} = 0$	$\gamma_{31} + \gamma_{32} + \gamma_{33} + \gamma_{34} = 0$
p. 185, line 16 (right after Eq. 4.63)	$\gamma_{13} = -\gamma_{12}$ and $\gamma_{14} = -\gamma_{11}$	$\gamma_{33} = -\gamma_{32}$ and $\gamma_{34} = -\gamma_{31}$
p. 185, line 18 (right after Eq. 4.63)	$\gamma_{11} = -1, \dots, \gamma_{14} = 1, \text{ and } \gamma_{12} = 1$	$\gamma_{31} = -1, \dots, \gamma_{34} = 1, \text{ and } \gamma_{32} = 1$

Page, line	Current Form	Correction
p. 185, line 19 (right before Eq. 4.64)	$\gamma_{13} = -1$	$\gamma_{33} = -1$
p. 188, Equation (4.70)	$\tilde{x}_1 = \frac{x_1 - 0.5(14 + 10)}{0.5(14 - 10)} = 0.5x_1 - 6$ $\tilde{x}_2 = \frac{x_3 - 0.5(25 + 30)}{0.5(30 - 25)} = 0.4x_2 - 11$ $\tilde{x}_3 = \frac{x_2 - 0.5(200 + 250)}{0.5(250 - 200)} = 0.04x_3 - 9$	$\tilde{x}_1 = \frac{x_1 - 0.5(14 + 10)}{0.5(14 - 10)} = 0.5x_1 - 6$ $\tilde{x}_2 = \frac{x_2 - 0.5(25 + 30)}{0.5(30 - 25)} = 0.4x_2 - 11$ $\tilde{x}_3 = \frac{x_3 - 0.5(200 + 250)}{0.5(250 - 200)} = 0.04x_3 - 9$ <p>In the second and third equations, after the first equals sign, x_3 (in the second equation) should be x_2 and x_2 (in the third equation) should be x_3.</p>
p. 189, Section 4.7.4.4	$L_2(\tilde{x}_1) = 3\tilde{x}_1 - 2$	$L_2(\tilde{x}_1) = 3\tilde{x}_1^2 - 2$

Page, line	Current Form	Correction
p. 189, Equation (4.72) ⁵	$\mathcal{A}_{part} = \begin{bmatrix} 1 & -1 & -1 & -1 & 1 & 1 & 1 & -1 & 1 & -1 & -1 & 1 \\ 1 & -1 & -1 & 1 & 1 & -1 & -1 & 1 & 1 & -1 & 1 & -1 \\ 1 & -1 & 1 & -1 & -1 & 1 & -1 & 1 & 1 & 1 & -1 & -1 \\ 1 & -1 & 1 & 1 & -1 & -1 & 1 & -1 & 1 & 1 & 1 & -2 \\ 1 & 0 & -1 & -1 & 0 & 0 & 1 & 0 & -2 & 2 & 2 & 2 \\ 1 & 0 & -1 & 1 & 0 & 0 & -1 & 0 & -2 & 2 & -2 & 2 \\ 1 & 0 & 1 & -1 & 0 & 0 & -1 & 0 & -2 & -2 & 2 & -2 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 & 0 & -2 & -2 & -2 & 1 \\ 1 & 1 & -1 & -1 & -1 & -1 & 1 & 1 & 1 & -1 & -1 & -1 \\ 1 & 1 & -1 & 1 & -1 & 1 & -1 & -1 & 1 & -1 & 1 & -1 \\ 1 & 1 & 1 & -1 & 1 & -1 & -1 & -1 & 1 & 1 & -1 & 1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{bmatrix}$	$\mathcal{A}_{part} = \begin{bmatrix} 1 & -1 & -1 & -1 & 1 & 1 & 1 & -1 & 1 & -1 & -1 & 1 \\ 1 & -1 & -1 & 1 & 1 & -1 & -1 & 1 & 1 & -1 & 1 & 1 \\ 1 & -1 & 1 & -1 & -1 & 1 & -1 & 1 & 1 & 1 & -1 & -1 \\ 1 & -1 & 1 & 1 & -1 & -1 & 1 & -1 & 1 & 1 & 1 & -1 \\ 1 & 0 & -1 & -1 & 0 & 0 & 1 & 0 & -2 & 2 & 2 & -2 \\ 1 & 0 & -1 & 1 & 0 & 0 & -1 & 0 & -2 & 2 & -2 & 2 \\ 1 & 0 & 1 & -1 & 0 & 0 & -1 & 0 & -2 & -2 & 2 & 2 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 & 0 & -2 & -2 & -2 & -2 \\ 1 & 1 & -1 & -1 & -1 & -1 & 1 & 1 & 1 & -1 & -1 & 1 \\ 1 & 1 & -1 & 1 & -1 & 1 & -1 & -1 & 1 & -1 & 1 & -1 \\ 1 & 1 & 1 & -1 & 1 & -1 & -1 & -1 & 1 & 1 & -1 & -1 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{bmatrix}$
p. 189, Equation (4.74) ⁶	$\bar{y} = [\dots \ 1 \ 1 \ 3 \ 1 \ 5 \ 4 \ 9 \ 6 \ 11]^T$	$\bar{y} = [\dots \ 1 \ 1 \ \mathbf{1} \ \mathbf{3} \ 5 \ 4 \ \mathbf{6} \ \mathbf{9} \ 11]^T$
p. 191, Figure 4.8	β_{13}	β_{12}

⁵ The last column of the matrix was shifted up by one row. The corrected matrix is provided. All subsequent calculations are still correct.

⁶ Only the last 9 elements of this vector are shown. Two groups of two digits were transposed. All subsequent calculations are still correct.

Page, line	Current Form	Correction
p. 191, Figures 4.10, 4.11	<i>There seems to be some minor differences in the graphs due to ordering of variables. The interpretation and final results are not affected.</i>	<i>See Appendix V: Updating Figures 44 and 45 for the Example in §4.7.4</i>
p. 196, Equation (4.90)	$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_{12} x_{12} + \beta_c x^2$	$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_{12} x_1 x_2 + \beta_c x^2$ The third term, $\beta_{12} x_{12}$, should be $\beta_{12} x_1 x_2$.
p. 198, line 17	<i>F</i> -statistic is 15.9 (> 6.4)	<i>F</i> -statistic is 47.8 (> 5.14)
Figures 4.13, 4.14, 4.15	<i>clarifying the axis labels</i>	<i>See Appendix IV: Updating Figures 4.13, 4.14, and 4.15 for the Example in §4.8.4</i>
p. 216, line 8	There are two types of differencing: true and periodic.	There are two types of differencing: true and periodic . (Adding bolding to emphasis the points.)
p. 220, Equation (5.27)	$A_Q(z^{-s}) = 1 + \sum_{i=1}^P \alpha_{si} z^{-si},$ $B_P(z^{-s}) = 1 + \sum_{i=1}^Q \beta_{si} z^{-si}.$	$\underline{A}_P(z^{-s}) = 1 + \sum_{i=1}^P \alpha_{si} z^{-si},$ $\underline{B}_Q(z^{-s}) = 1 + \sum_{i=1}^Q \beta_{si} z^{-si}.$
p. 221, right after Equation (5.27)	The pure seasonal autoregressive model...	The pure seasonal moving average model...

Page, line	Current Form	Correction
p. 226, computation of σ_y , 3 rd line	$= \sigma^2 + 0.5^2 \sigma^2 + 0.1\sigma^2 =$	$= \sigma^2 + 0.5^2 \sigma^2 + \underline{0.1^2} \sigma^2 =$
p. 254, Equation (5.102)	$\sigma_{t+1 t}^2 = \gamma(0) - \vec{\gamma}_t^T \Gamma_t^{-1} \vec{\gamma}_t$	$\sigma_{t+\underline{1} t}^2 = \gamma(0) - \vec{\gamma}_t^T \Gamma_t^{-1} \vec{\gamma}_t$ (The subscript on the σ should be $t + \underline{1} t$ rather than $t + 1 t$.)
p. 255, Equation (5.105)	$y_{t+\tau} = E(y_{t+\tau} y_t, y_{t-1}, y_{t-2}, \dots) = \sum_{j=\tau}^{\infty} h_j e_{t+\tau-j}$	$\underline{y}_{t+\underline{\tau} t} = E(y_{t+\tau} y_t, y_{t-1}, y_{t-2}, \dots) = \sum_{j=\tau}^{\infty} h_j e_{t+\tau-j}$
p. 256, 1- step-ahead	$\begin{aligned} \hat{y}_{101 100} &= 0.436e_{99} - 0.293e_{98} - 0.763e_{97} \\ &= 0.436(0.5044) - 0.293(-0.4402) - 0.763(-1.3221) \\ &= 1.3577 \end{aligned}$	$\begin{aligned} \hat{y}_{101 100} &= 0.436e_{100} - 0.293e_{99} - 0.763e_{98} \\ &= 0.436(0.8410) - 0.293(0.5044) - 0.763(-0.4402) \\ &= 0.5548 \end{aligned}$
p. 256, 1- step-ahead	...gives a 95% confidence interval as 1.4±2.1.	...gives a 95% confidence interval as 0.6±2.1.
p. 256, 2- step-ahead	$\begin{aligned} \hat{y}_{102 100} &= -0.293e_{99} - 0.763e_{98} \\ &= -0.293(0.5044) - 0.763(-0.4402) \\ &= 0.1881 \end{aligned}$	$\begin{aligned} \hat{y}_{102 100} &= -0.293e_{100} - 0.763e_{99} \\ &= -0.293(0.8410) - 0.763(0.5044) \\ &= -0.6312 \end{aligned}$
p. 256, 2- step-ahead	$\hat{\sigma}_{102 100}^2 = 1.0807(1^2 + 0.436^2) = 1.2708$	$\hat{\sigma}_{102 100}^2 = 1.0807(1^2 + 0.436^2) = \underline{1.286}$

Page, line	Current Form	Correction
p. 256, 2-step-ahead	95% confidence interval as 0.2 ± 2.5	95% confidence interval as $\underline{-0.6} \pm 2.5$
p. 268, Equation (5.132)	$\Sigma_{t-1 t} = \mathcal{A}\Sigma_{t-1 t}\mathcal{A}^T + \Sigma_{\omega}$	$\Sigma_{t t-1} = \mathcal{A}\Sigma_{t-1 t-1}\mathcal{A}^T + \Sigma_{\omega}$
p. 268, Equation (5.134)	$\mathcal{K}_t = \Sigma_{t-1 t}\mathcal{C}^T (\mathcal{C}\Sigma_{t-1 t}\mathcal{C}^T + \Sigma_e)$	$\mathcal{K}_t = \Sigma_{t t-1}\mathcal{C}^T (\mathcal{C}\Sigma_{t t-1}\mathcal{C}^T + \Sigma_e)^{-1}$
pp. 287 – 289	m -step	\underline{t} -step
p. 288, line 4	where some L is a rational function of z^{-1}	where <u>L is some rational</u> function of z^{-1}
p. 293, Equation (6.31) p. 293, line after Equation (6.31)	$t t - 1$	<u>$t + 1 t$</u> (Note both formulations are equivalent, but for consistency, we should use the corrected form.)

Page, line	Current Form	Correction
p. 294, Equation (6.41)	$\begin{aligned} \text{var}\left(\varepsilon_i\left(\bar{\theta}, \hat{\theta}\right)\right) &= \text{var}\left(\Phi_e\left(z^{-1}, \bar{\theta}, \hat{\theta}\right)u_i\right) \\ &+ \text{var}\left(\left(\Phi_e\left(z^{-1}, \bar{\theta}, \hat{\theta}\right) - \mathcal{I}\right)e_i\right) \\ &+ \text{var}\left(e_i\right) \end{aligned}$	$\begin{aligned} \text{var}\left(\varepsilon_i\left(\bar{\theta}, \hat{\theta}\right)\right) &= \text{var}\left(\Phi_u\left(z^{-1}, \bar{\theta}, \hat{\theta}\right)u_i\right) \\ &+ \text{var}\left(\left(\Phi_e\left(z^{-1}, \bar{\theta}, \hat{\theta}\right) - \mathcal{I}\right)e_i\right) \\ &+ \text{var}\left(e_i\right) \end{aligned}$ <p>The first Φ_e should be Φ_u instead.</p>
p. 303, first paragraph of §6.4	In such cases, using and understanding routine operating data are important.	In such cases, using and understanding routine operating data is important.
p. 305, line 12	direction identification	<u>direct identification</u>
p. 310, §6.5.1, second paragraph	Wiener-Hammerstein models are useful with the actuators or sensors have...	<u>Wiener</u> -Hammerstein models are useful with the actuators or sensors have...
p. 314, Figure 6.10	(cm/s)	(cm ³ /s)
p. 316, Equation (6.82), second line	$\frac{(7.8 \times 10^{-4} \pm 2 \times 10^{-5})z^{-2}}{1 - (1.664 \pm 0.007)z^{-1} + (0.695 \pm 0.007)z^{-1}u_2}$	$\frac{(7.8 \times 10^{-4} \pm 2 \times 10^{-5})z^{-2}}{1 - (1.664 \pm 0.007)z^{-1} + (0.695 \pm 0.007)\underline{z}^{-2}u_2}$

Page, line	Current Form	Correction
p. 340, Table 7.3	start, *	<u>star</u> , *
p. 311, Fig. 6.2		(See Figure 1 for the corrected image, which clarifies the relationship between the flows in the 4 tanks.)
p. 343, Table 7.7, first line	=regress(b	=regress(<u>y</u>
p. 347, Table 7.10, second line, first column	mARab=ar(z,[na,nb])	mARa=ar(z,[na])
p. 347, Table 7.10, second line, second column	orders na and nb ... an idpoly object, mARab	order na ... an idpoly object, mARa
p. 353, line 24	%Obtain the autocorrelation values	%Obtain the <u>cross</u> correlation values
p. 356, third computer text box	A=A([1, size(A,1)],:);	A=A([1, <u>3</u> :size(A,1)],:);

Page, line	Current Form	Correction
p. 359, first line of second computer text box	%Script for solving linear regression problems in MATLAB	%Script for solving <u>nonlinear</u> regression problems in MATLAB
p. 361, computer text box	cm/s	cm ^{<u>3</u>} /s
p. 363	Microsoft Office 2013	Microsoft Office <u>2016</u>
p. 374, §8.5	In order to start Solver, in Excel 2007 or newer,... Solver should be there as shown in Fig. 8.7.	In order to start <u>the Data Analysis Add-In</u> , in Excel 2007 or newer,... <u>The Data Analysis Add-In</u> should be there as shown in Fig. 8.7.
p. 379, item 3)	Median – Q1, Q3, and Maximum – Q3	Median – Q1, <u>Q3 – Median</u> , and Maximum – Q3
p. 379, item 4)	Q3	<u>Q3 – Median</u>
p. 399, Chapter 2, 15)	15) T;	15) <u>E</u> ;

Page, line	Current Form	Correction
p. 401, last line	24) left graph: 10	24) left graph: 9

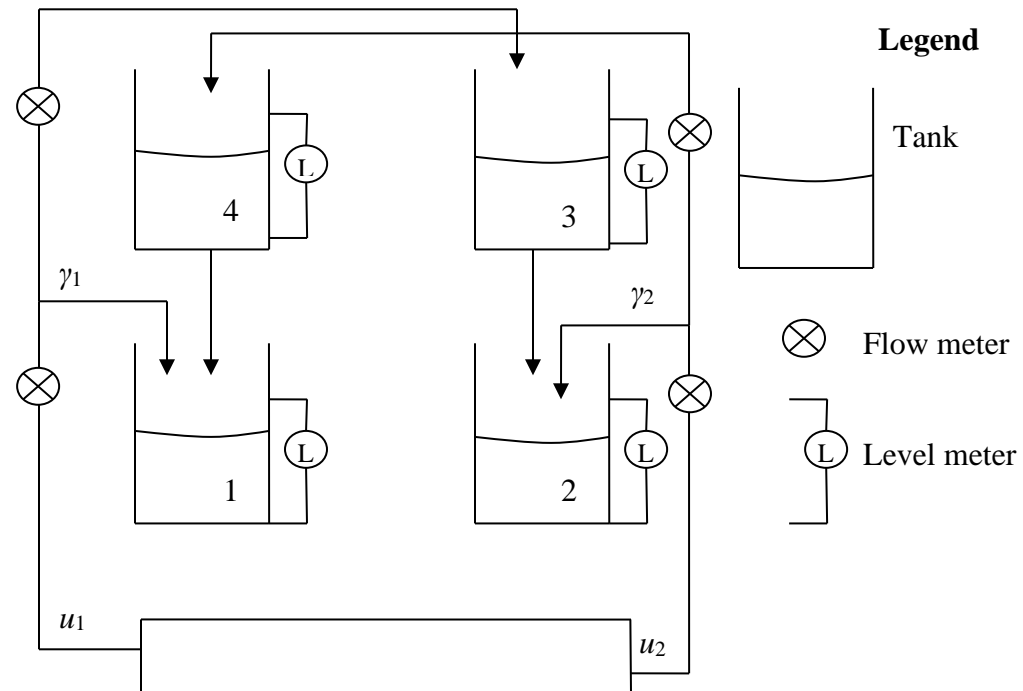
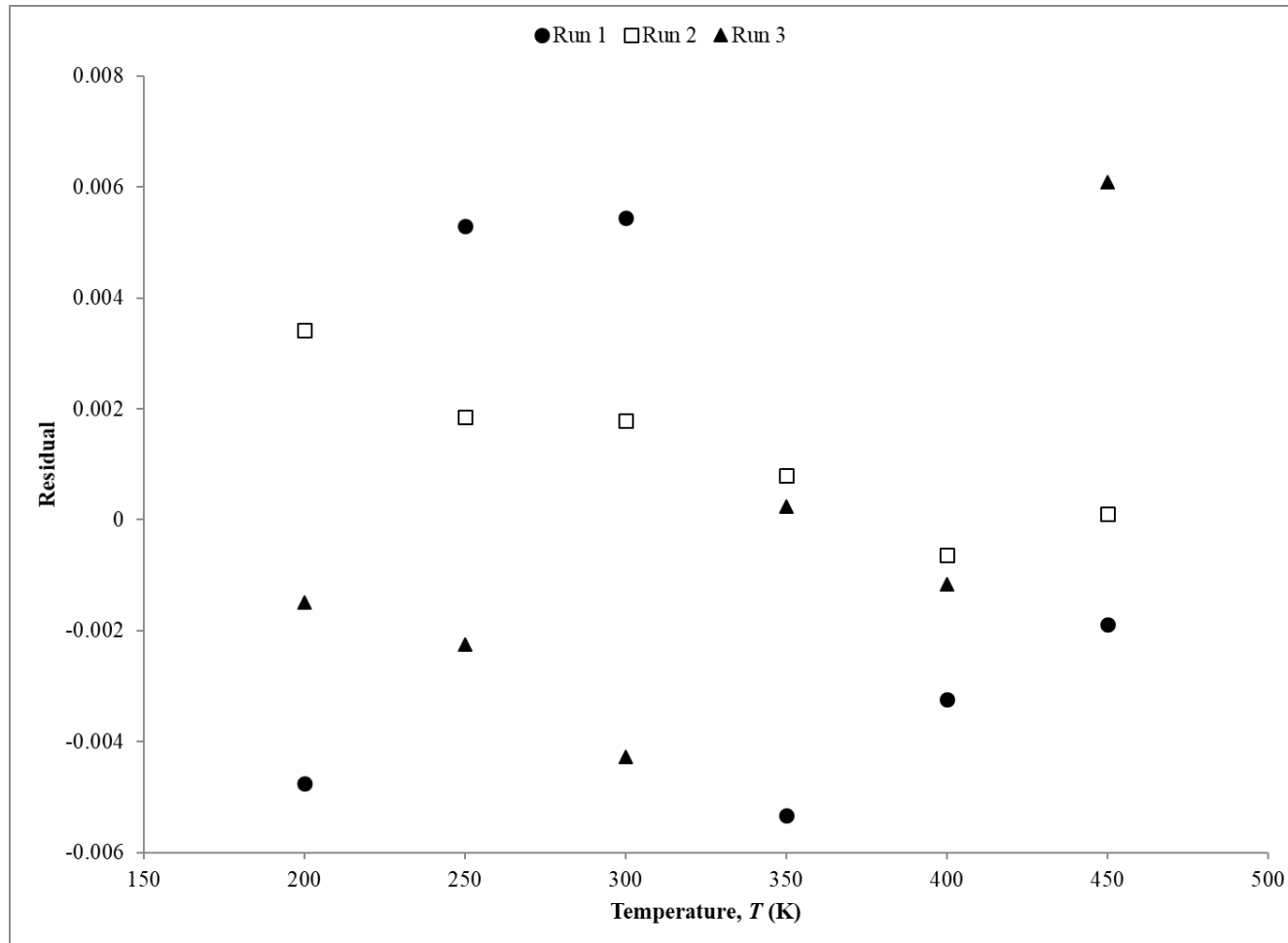


Figure 1: Corrected Fig. 6.2

Yuri A.W. Shardt would like to thank his students in the *Intelligent Regelung* (en: *Smart Control*) course, Thomas Donnelly, Alexandru Vasile, and Heiko Weiß for pointing out typos and unclear sections.

Appendix I: Correction to Figure 3.4 (bottom, left) and corrected text**Corrected Text:**

Secondly, Fig. 3.4 shows the normal probability plots and the residuals as a function of the temperature for both cases. From the normal probability plots, it would seem that the residuals for both models are quite similar. On the other hand, there do seem to be

more abnormal points in the linearised model case, suggesting that the residuals may violate the assumption of normality. Examining the residual as a function of temperature plots shows some interesting results. Firstly, for the linearised model, Run **2** **has a different behaviour from the other two runs**. Secondly, there are few, if any, **positive** deviations compared with the large number of **negative** deviations. Based solely on the linearised model, one would have to conclude that Run **2** was abnormal, and the collection of the data would warrant additional scrutiny. On the other hand, when the nonlinear case is used, the results are quite different and a different pattern emerges. First, Run **2** is no longer usual, and there are now both positive and negative residuals in equal magnitude. Second, it would seem that the residuals depend on the temperature with a lower value around 350 to 400 K and higher values at the extremes. Since Arrhenius's equation is an accepted model for the observed behaviour, this feature could potentially be attributed to issues in experimental design, that is, the conditions and methods by which the data were obtained, for example, faulty measurements or an incomplete procedure.

It is interesting to note that, although both the linear and nonlinear methods provided similar parameter estimates and confidence intervals, the residual analysis is quite different. In the linear case, it would be concluded that Run **2** had some abnormal residuals and would require additional analysis. In the nonlinear case, it would be concluded that there seems to be some temperature dependency of the residuals. This shows the importance of selecting an appropriate method for the given problem.

Appendix II: Correction for Example 4.2, Parts b), c), and d)

b) A normal probability plot of the effects is shown in Figure 37. **The effects that lie far from the expected normal distribution values are those that are significant because they are not chance values. The most significant effects have been circled and labelled. Therefore, the significant effects are those denoted as A, C, D, AC, and AD. The effect due to B is negligible.**

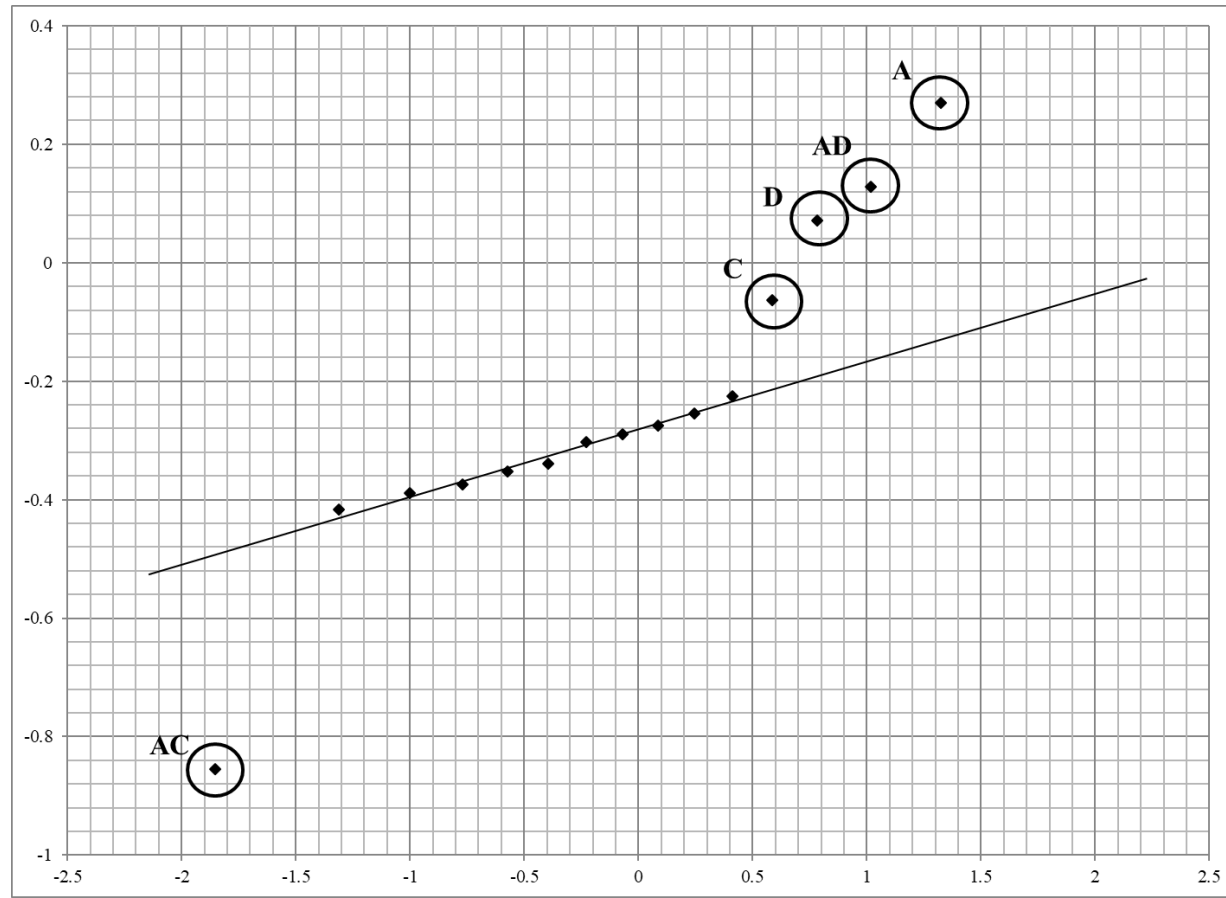


Figure 37: Normal probability plot of the effects

c) Dropping the B factor will produce a 2^3 -factorial experiment with 2 replicates. In addition to dropping the terms associated with the B factor, all other terms will also be dropped. Since the design is orthogonal, we can drop the terms, without needing to recalculate anything. Therefore, the simplified model is given as

$$y = 70.06 + 10.8x_1 + 4.94x_3 + 7.31x_4 - 9.06x_1x_3 + 8.31x_1x_4$$

d) The residuals for this case are shown in Figure 38. It can be seen that they are more or less normally distributed. Furthermore, since the reduced model has an $R^2 = 0.966$ with all significant parameter values, it can be concluded that the results are probably good.

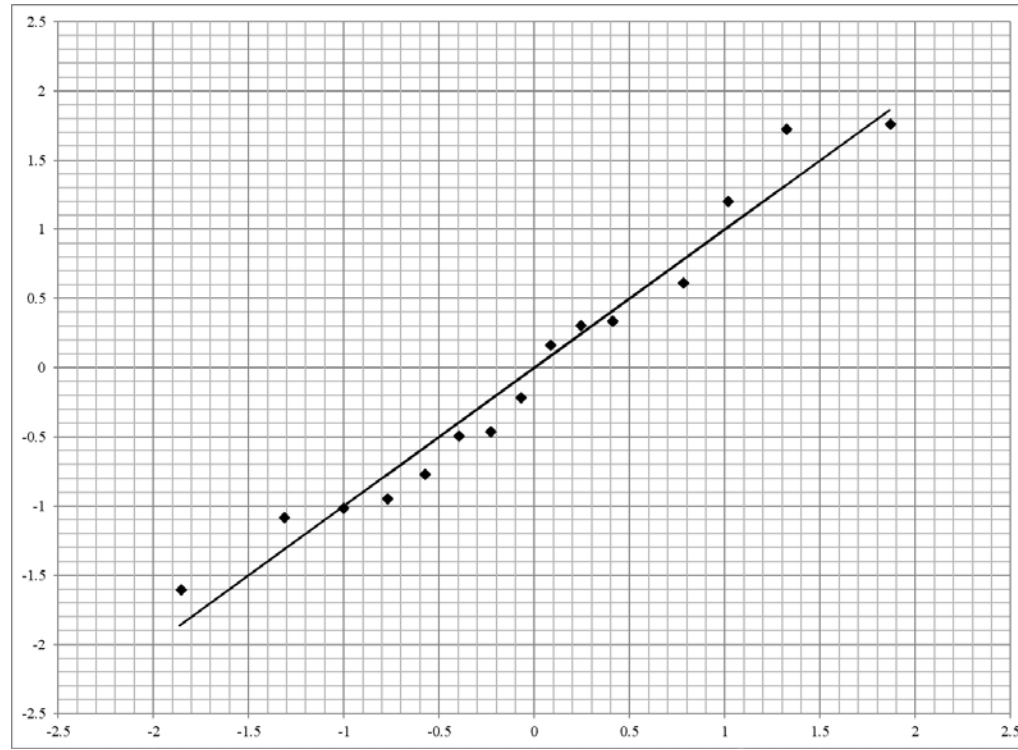
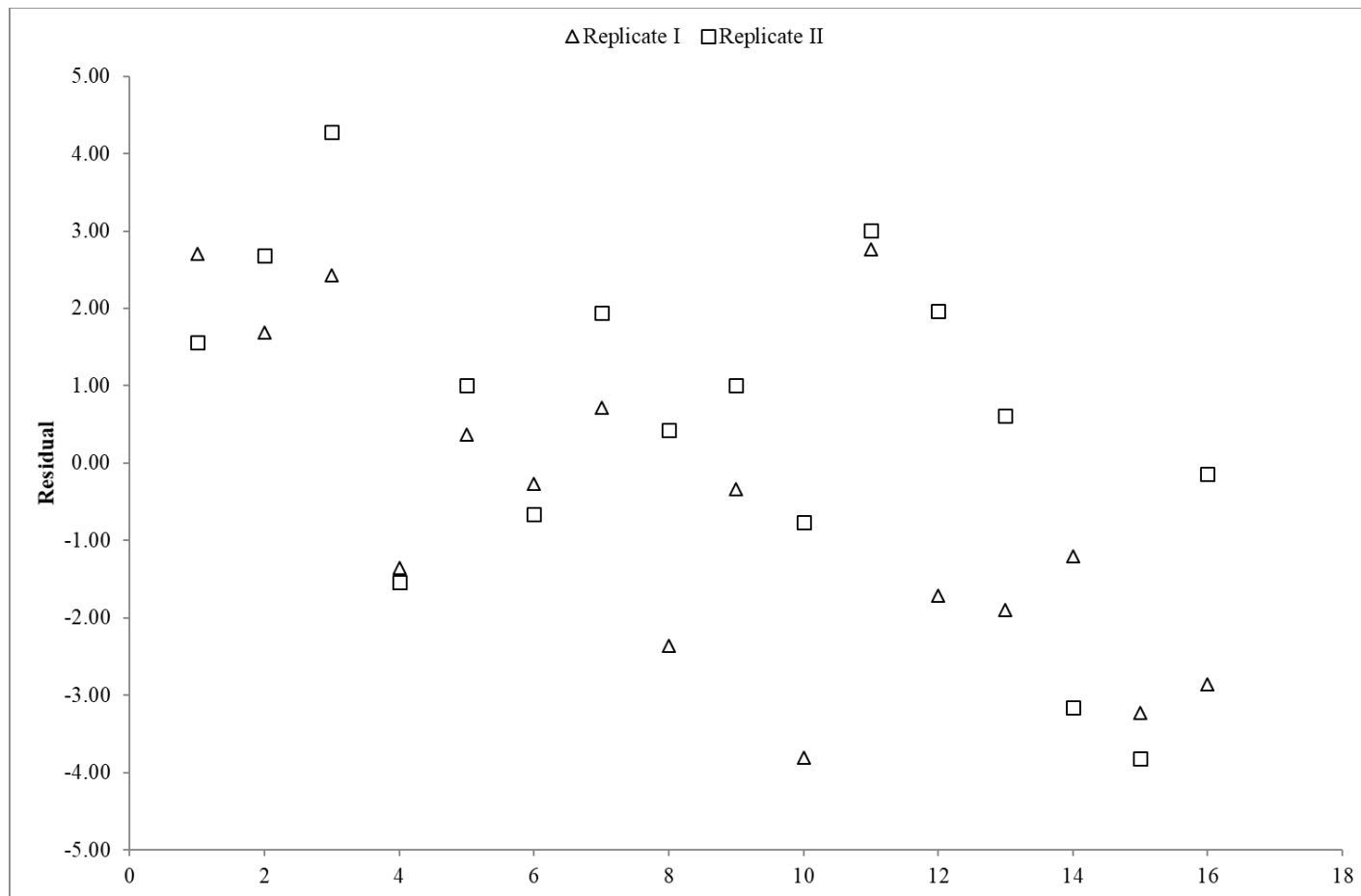
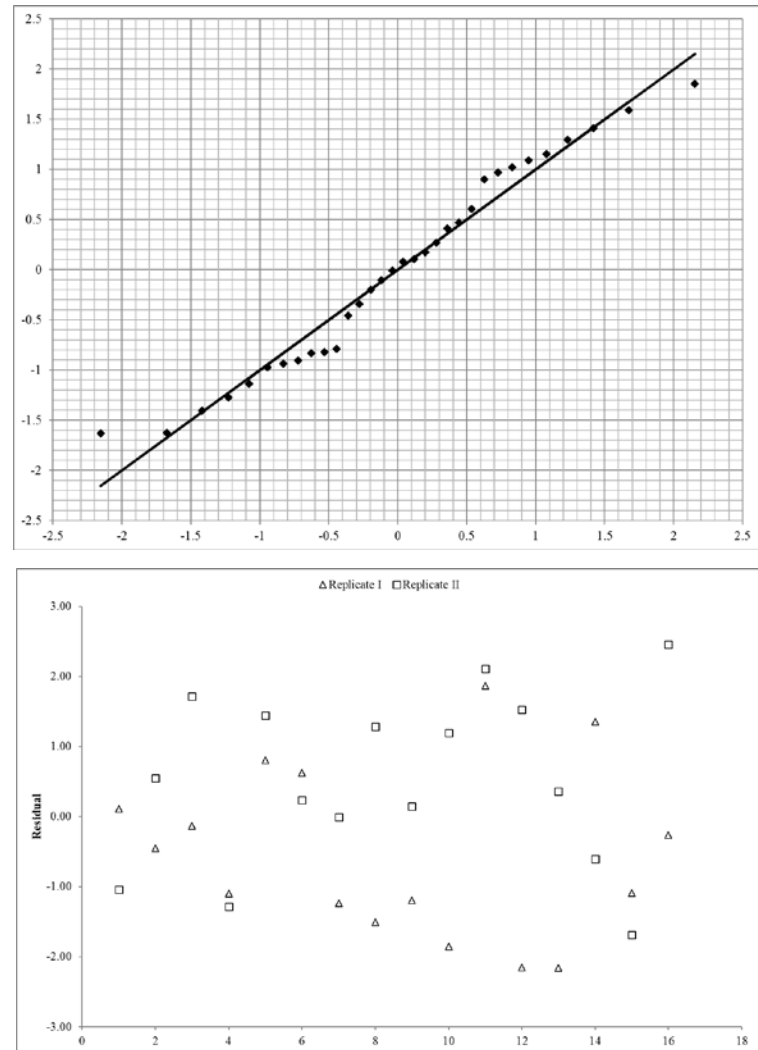
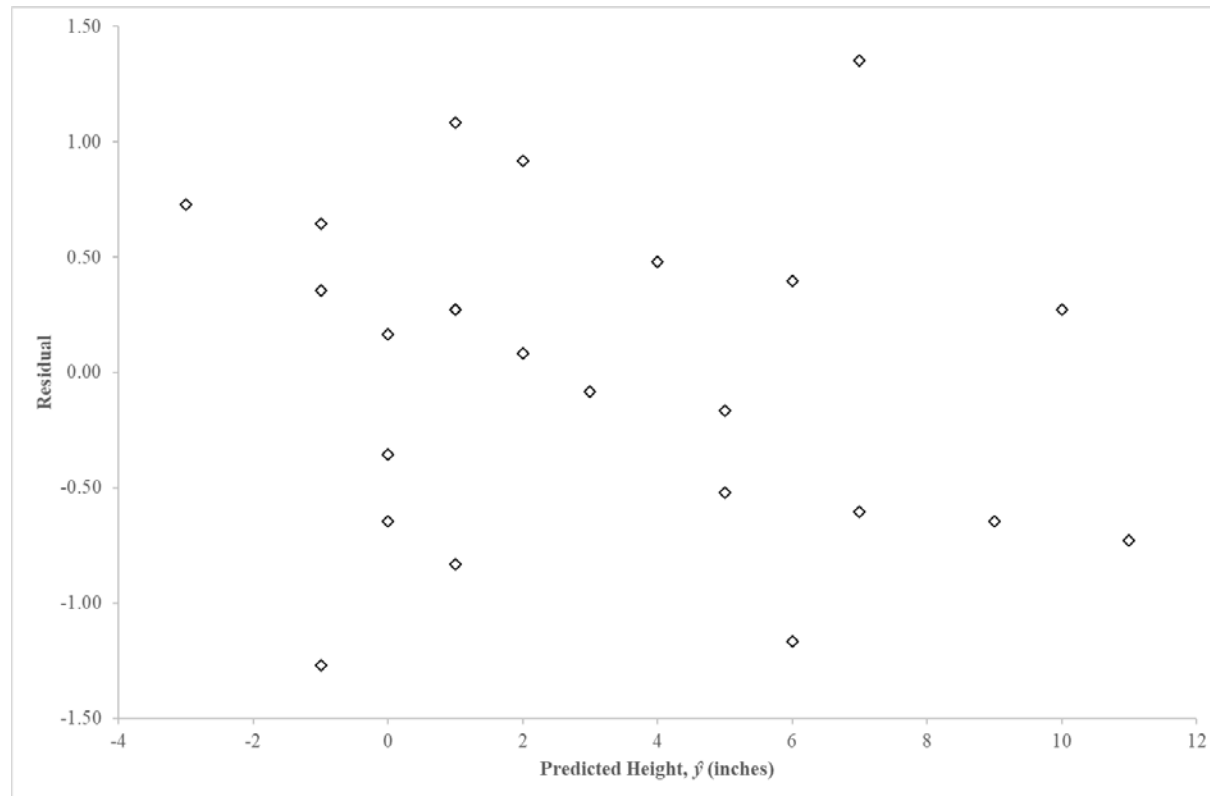


Figure 38: Normal probability plot of the residuals for the reduced model

Appendix III: Correction for Example 4.9, Figure 4.6 (bottom)

Appendix IV: Correction for Example 4.9, Figure 4.7

Appendix V: Updating Figures 4.10 and 4.11 for the Example in §4.7.4Figure 4.10: Residuals as a function of \hat{y}

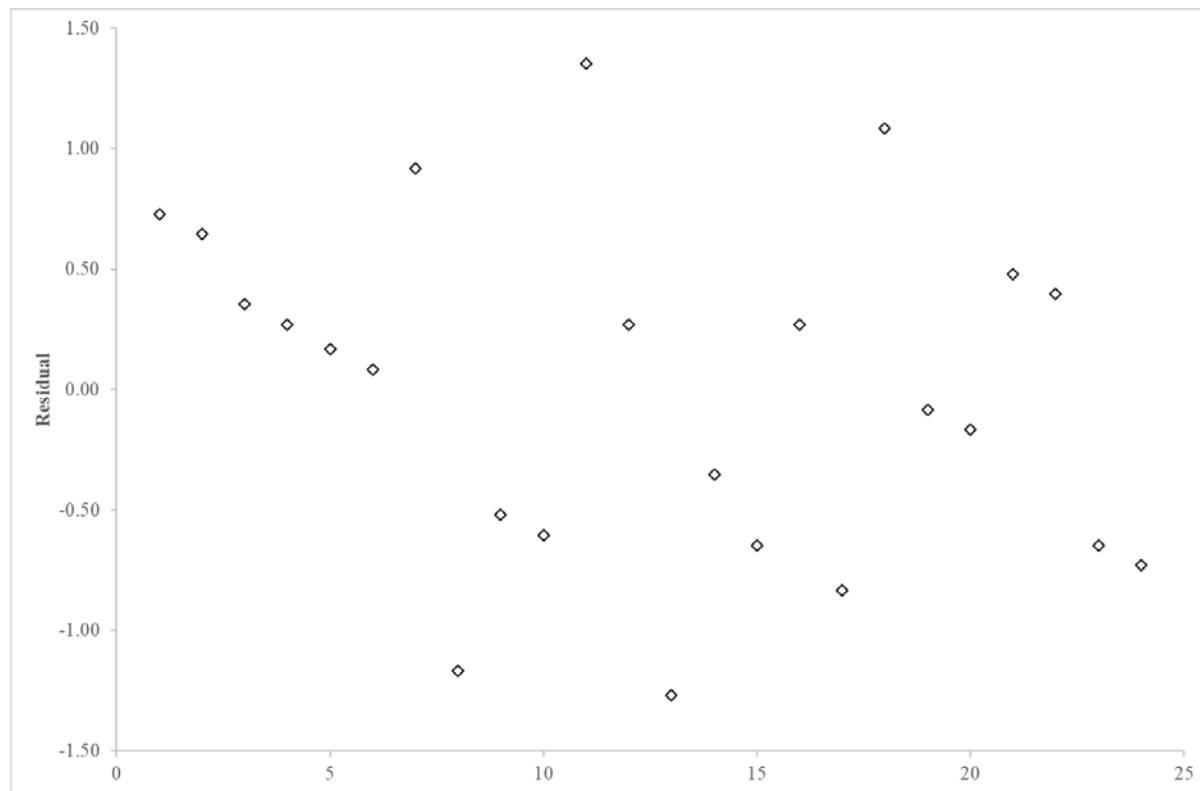


Figure 4.11: Time series plot of the residuals

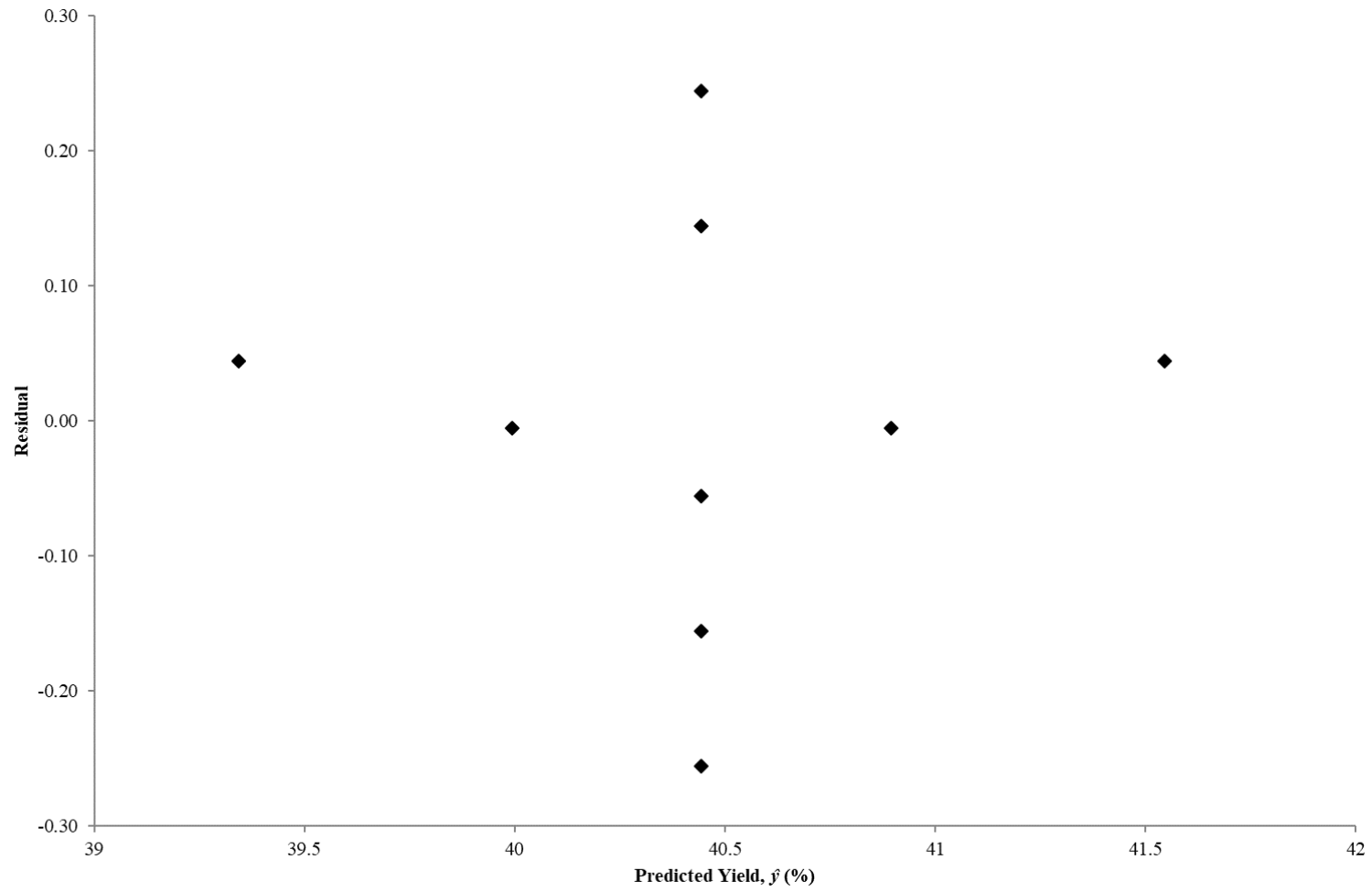
Appendix VI: Updating Figures 4.13, 4.14, and 4.15 for the Example in §4.8.4

Figure 4.13

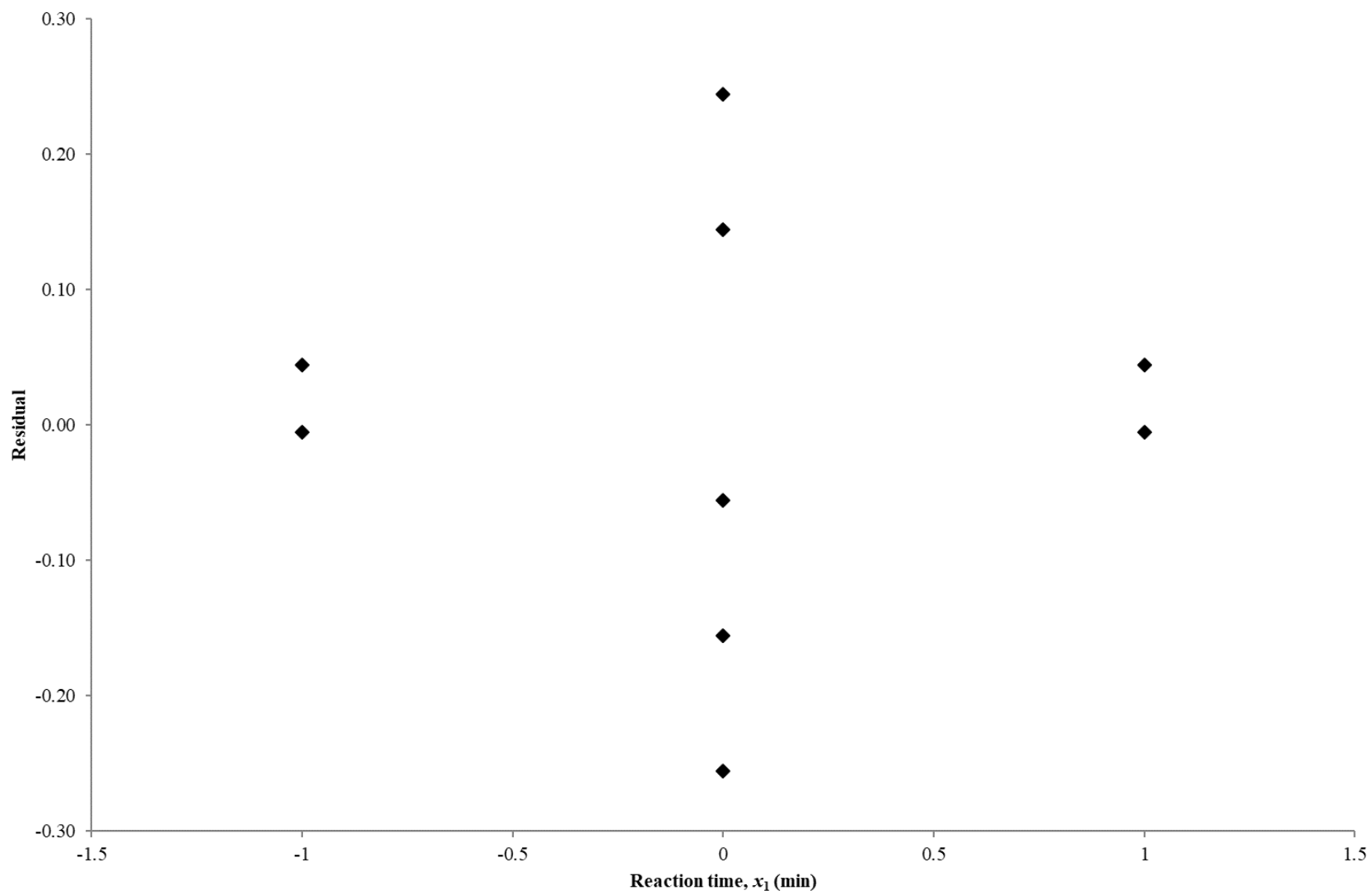


Figure 4.14

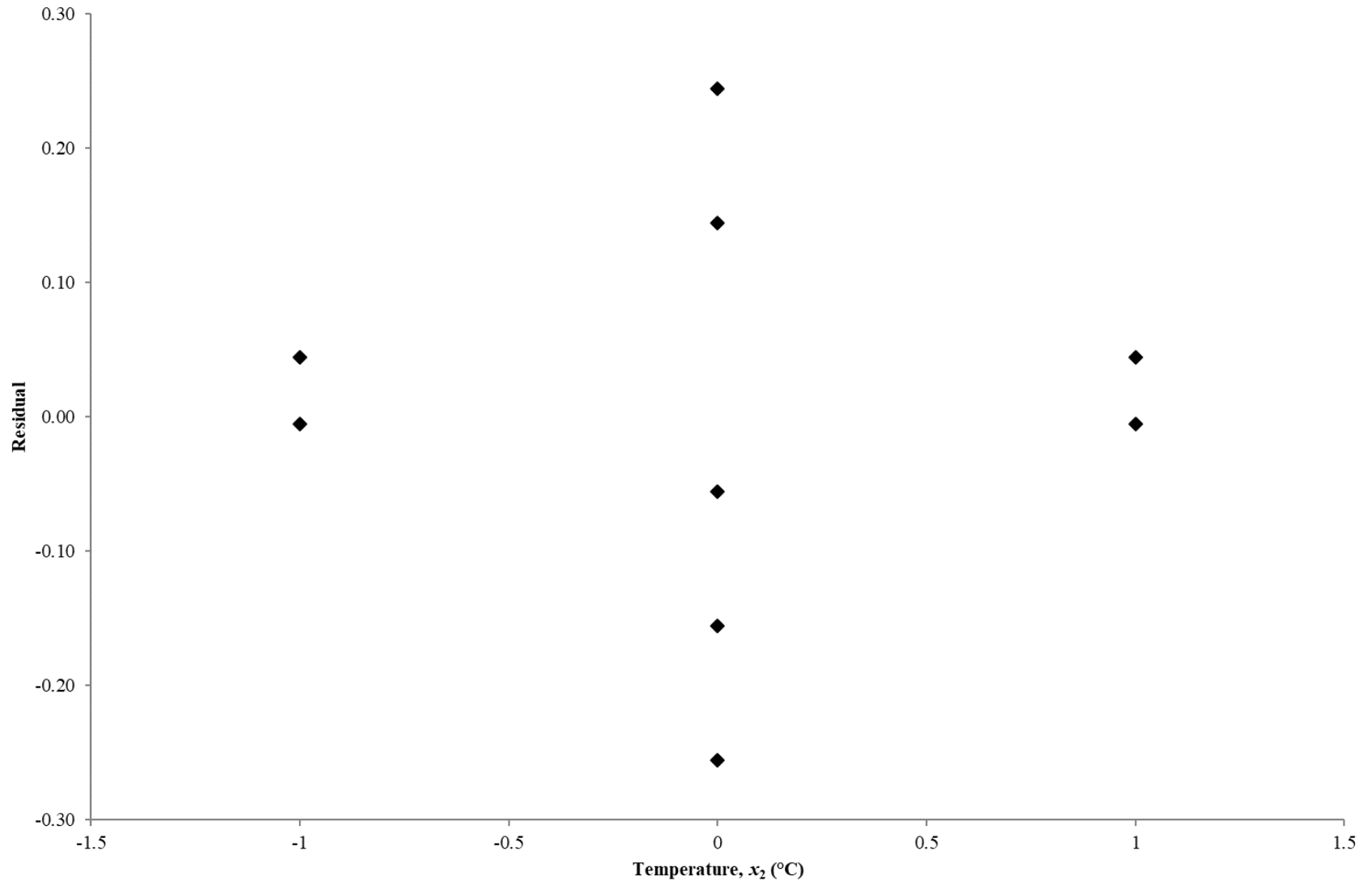


Figure 4.15