

**Errata List For**  
**NONLINEAR SYSTEMS – Second Edition**  
**Updated on November 17, 2004**  
**Please e-mail error reports to**  
**khalil@msu.edu**

The errors reported here are for the first printing of the second edition, which was published in December, 1995. Many of the errors were corrected in the second printing.

**Chapter 1**

1. Page 45, Footnote: Change “Chapter 6” to “Chapter 7”.

**Chapter 2**

1. Page 83, Line 1: Change “Chapter 7” to “Chapter 8”.
2. Page 83, Line 11: Change “(2.10)” to “(2.9)”.
3. Page 91, Exercise 2.19: Change “ $x \in R^n$ ” to “ $x \in R^n, x \neq 0$ ”.
4. Page 92, Exercise 2.24: Change “Theorem 2.2” to “Theorem 2.3” and “contraction principle” to “contraction mapping principle”.

**Chapter 3**

1. Page 111, Line 5: Change “counterexample” to “counter example”.
2. Page 113, Line 1: Change “satisfy” to “are locally Lipschitz and satisfy”.
3. Page 115, Line 25: Remove the sentence “However, checking ... principal axes”. This sentence is wrong. See Exercise 4.9 of the third edition.
4. Page 135, the sixth bullet of Definition 3.2: Change the first line of the bullet to: “globally uniformly asymptotically stable if it is uniformly stable,  $\delta(\epsilon)$  can be chosen to satisfy  $\lim_{\epsilon \rightarrow \infty} \delta(\epsilon) = \infty$ , and for each pair ...”.
5. Page 149, Line 8 of Theorem 3.12: Change “a function” to “a continuously differentiable function”.
6. Page 158, Exercise 3.17: Assume  $g(x_3)$  is locally Lipschitz.
7. Page 162, Exercise 3.37, Line 7: Change “ $k_2$ , and  $k_3$  are positive” to “ $k_3$ , and  $k_5$  are positive”.
8. Page 162, Exercise 3.38: Assume  $\alpha(t)$  is bounded.
9. Page 164, Exercise 3.44: assume  $g(t)$  is bounded.

**Chapter 4**

1. Page 176, Line 9: Change “ $-\|y\|_2^4$ ” to “ $-\frac{1}{2}\|y\|_2^4$ ”
2. Page 176, Line 11: Change to “ $\dot{V} \leq -\frac{1}{4}\|y\|_2^4$ , for  $\|y\|_2 < \frac{1}{4k}$ ”
3. Page 192, Theorem 4.4: Assume that  $f(t, 0)$  is uniformly bounded for all  $t \geq 0$ .
4. Page 198, Exercise 4.12: Change “ $h(x_1)$ ” to “ $h_1(x_1)$ ” and in the hint take  $h(x) = g_1(x_1)h_1(x_1)$ .
5. Page 202, Exercise 4.25: Take  $\alpha(t) = \sin t$ .

**Chapter 5**

1. Page 209, Line 7 from the bottom: Change “a putting” to “putting”.

2. Page 211, Definition 5.1, Line 3: Change “ $T(\alpha)$ ” to “ $T(\alpha, b)$ ”.
3. Page 212, Corollary 5.1, Line 1: Change “assumption” to “assumptions”.
4. Page 212, Corollary 5.1, Line 3: Change “ $D$ ” to “ $B_r$ ”.
5. Page 224, Lines 1 and 2: Change “ $\phi(t, \tau)$ ” to “ $\phi(t, t_0)$ ”.
6. Page 226, Lemma 5.8: It is better to state this lemma with  $t_0$  replaced by zero. See Lemma 9.5 of the third edition.
7. Page 252, Exercise 5.7, Part (b), line 2: Change “ $\beta < 0$ ” to “ $\beta \leq 0$ ”.
8. Page 252, Exercise 5.7, Part (b), line 4: Change “ $\beta \geq 0$ ” to “ $\beta > 0$ ”.
9. Page 257, Exercise 5.27, Line 1: Change “(5.41)” to “(5.42)”.
10. Page 257, Exercise 5.27, Line 2: Change “ $c_4 h$ ” to “ $c_4 h^2$ ”.

## Chapter 6

1. Page 261, Line 2 from the bottom: Change “class of autonomous” to “class of time-invariant”.
2. Page 266, Footnote: Change “ $g \in \mathcal{L}_{pe}$ ” to “ $g \in \mathcal{L}_{qe}$ ” and “ $p \in [0, \infty]$ ” to “ $p \in (1, \infty)$ ”.
3. Page 269, Third line after (6.5): Change “ $D_u \in R^m$ ” to “ $D_u \subset R^m$ ”.
4. Page 271, Lines 1, 3, and 7: Change “ $V(t)$ ” to “ $V(t, x(t))$ ”.
5. Page 272, Line 4: Change “(5.25)” to “(6.6)”.
6. Page 272, Line 7: Change “(6.11)” to “(6.6)”.
7. Page 274, Corollary 6.2, Line 2: Change “differentiable and” to “differentiable.”.
8. Page 275, Line 7 of Section 6.3: Change “ $\|y_\tau\|_{\mathcal{L}_\infty}$ ” to “ $\|y(t)\|$ ”.
9. Page 276, Line 10 of Section 6.4: Change “autonomous systems” to “time-invariant systems”.
10. Page 277, Theorem 6.5, Line 1: Change “autonomous” to “time-invariant”.
11. Page 284, Exercise 6.3, Part (b): Change “ $\beta = (1/a)^{1/3}$ ” to “ $\beta = (1/a)^{1/2}$ ”.
12. Page 285, Exercise 6.10: Change “autonomous system” to “time-invariant system”.
13. Page 287, Line 2: Change “ $d$ ” to “ $w$ ”.
14. Page 287, Exercise 6.16, Part (a); Require  $0 < \delta < 1$ .
15. Page 288, Exercise 6.16, Part (d): Change “ $u_1(t - t_1)$ ” to “ $u_1(t + t_1)$ ” and “ $y_1(t - t_1)$ ” to “ $y_1(t + t_1)$ ”.

## Chapter 8

1. Page 328, Line 1: Change “ $[0, \infty)$ ” to “ $[t_0, \infty)$ ”.
2. Page 334, Line 14: Change “(8.21)” to “(8.17)”.
3. Page 334, Line 17: Change “(8.21)” to “(8.17)”.
4. Page 334, Line 17: Change “(8.22)” to “(8.18)”.
5. Page 342: Replace the last paragraph of Section 8.4 by “Let us conclude by noting that the foregoing procedure may be used to show the existence of an unstable limit cycle. This can be done by reversing time in (8.26), that is, replacing  $t$  by  $\tau = -t$ . If the system has a stable limit cycle in reverse time, it will have an unstable limit cycle in forward time.”.
6. Page 345, Equation (8.41): Change “ $f(t, x)$ ” to “ $f_{av}(x)$ ”.

## Chapter 9

1. Page 355, Example 9.2, Line 1: Remove “;see Figure 3.1”.
2. Page 361, Equation (9.21) and Page 384, Equation (9.49): Change “ $\hat{y}(t/\epsilon)$ ” to “ $\hat{y}((t - t_0)/\epsilon)$ ”
3. Page 370, Line 4: Change “Example 7.2” to “Example 7.3”.
4. Page 375, Line 18: Change “(9.34)” to “(9.35)”.
5. Page 379, Line 17: Change “(9.38)” to “(9.37)”.
6. Page 393, Exercise 9.20, Line 2: Change “ $V$ ” to “ $V_a$ ”.
7. Page 393, Exercise 9.20, Part (b), Line 4: Change “ $\Omega$ ” to “ $\omega$ ”.
8. age 394, Line 5: Change “(f)” to “(g)”.
9. Page 397, Exercise 9.28, Line 4: Change “where where’ to “where”.
10. Page 397, Exercise 9.28, Line 4: Change “ $G(x, u)$ ” to “ $g(x, u)$ ”.

## Chapter 10

1. Page 406, Line 7: Change the (1,1) element of the matrix<sup>1</sup> from “ $s$ ” to “ $s + 1$ ”
2. Page 406, Line 11: Change the (1,1) element of the matrix from “ $\omega^2$ ” to “ $\omega^2 + 1$ ”
3. Page 406, Line 13: Change the (1,1) element of the matrix from “ $s/(s + 1)$ ” to “ $(s + 2)/(s + 1)$ ”
4. Page 406, Line 16: Change the (1,1) element of the matrix from “ $2\omega^2/(1 + \omega^2)$ ” to “ $2(2 + \omega^2)/(1 + \omega^2)$ ”
5. Page 410, Line 3: Change “ $w \in R$ ” to “ $\omega \in R$ ”.
6. Page 414, Line 2: Change “radius  $\gamma_2 > 0$ ” to “radius  $(1/\gamma_2) > 0$ ”.
7. Page 414, Line 3: Change “ $\gamma_2$ ” to “ $1/\gamma_2$ ”.
8. Page 432, Example 10.8: Change “ $e_2 = \psi(t, y_2)$ ” to “ $y_2 = \psi(t, e_2)$ ”.
9. Page 437, Equation (10.45): Change “ $\dot{V}(x(t))$ ” to “ $\dot{V}(x(t), u(t))$ ”.
10. Page 444, Lines 2 and 3: Change “ $\mathcal{L}_e^m$ ” to “ $\mathcal{L}_2^m$ ”.
11. Page 444, line 6 from the bottom: Change “ $\frac{\partial V}{\partial x}$ ” to “ $\frac{\partial V}{\partial x} f$ ”
12. Page 469, Exercise 10.2, Part (b): Assume  $\mathcal{D} = 0$ .
13. Page 469, Exercise 10.2, Part (b), Line 4: Change “ $Z(s)$ ” to “ $G(s)$ ”.
14. Page 470, Exercise 10.11: Change “ $\mathcal{D}$  is nonsingular” to “ $\mathcal{D} + \mathcal{D}^T$  is nonsingular”.
15. Page 475, Exercise 10.32, Line 6: Change “where,” to “where”.
16. Page 475, Exercise 10.32, Part (b): Assume  $K$  is symmetric.

## Chapter 11

1. Page 489, Line 13: Change the right-hand side from “ $\frac{a_0 c}{a c_0} \sin \delta$ ” to “ $\frac{c}{a} \left[ \frac{a_0}{c_0} \sin \delta + k_1(\theta_{ss} - \delta) \right]$ ”.
2. Page 492, Line 1: Change “Exercise 11.2” to “Example 11.2”.
3. Page 495, Line 1: In the subscript of the partial derivative, change “ $u = c\sqrt{2x}$ ” to “ $u = c\sqrt{2\alpha}$ ”.

---

<sup>1</sup>This  $Z(s)$  and the one on Line 13 need to be corrected because  $Z(0) + Z^T(0)$  is singular.

4. Page 495, line 7: Change “ $\omega_n^2$ ,” to “ $\omega_n^2 = 0$ ,”.
5. Page 501, Equation (11.42): Change “ $-v]$ ” to “ $-y]$ ”.
6. Page 503, Line 3 from the bottom: Change “ $z = \psi_m$ ” to “ $z = \bar{z}(\alpha)$ ”.
7. Page 507, Line 9 from the bottom: Change “be a done” to “be done”.
8. Page 513, Line 14: Change “ $+m > 0$ ” to “ $+mI > 0$ ”.
9. Page 514: Remove Exercise 11.10 because it is the same as Exercise 11.9.
10. Page 515: Remove Exercise 11.17 because it is the same as Exercise 11.16.

## Chapter 12

1. Page 535, Line 14: Change “ $\dot{y} = x_2 + x_2[\dots]$ ” to “ $\dot{y} = x_2 + 2x_2[\dots]$ ”.
2. Page 541, Line 3: Change “ $\alpha_0(\eta, \xi)]^T$ ” to “ $\alpha_0(\eta, \xi)]$ ”.
3. Page 544, Line 8 from the bottom: Change “ $D \in R^{n+m}$ ” to “ $D \subset R^{n+m}$ ”.
4. Page 554, line 18: Change “ $k_1 = 1600$ ” to “ $k_1 = -1600$ ” and “ $k_2 = 40$ ” to “ $k_2 = -40$ ”.
5. Page 565, Line 2: Change “ $r - 1$ ” to “ $r - k - 1$ ”.
6. Page 568, Line 14; Change “From,” to “From”.

## Chapter 13

1. Page 586, Example 13.4, Line 8: Change “ $|h(t)| \leq H$ ” to “ $|h(t)/\hat{c}| \leq H$ ”.
2. Page 587, Lemma 13.1, Line 2: Change “(13.1)” to “(13.2)”.
3. Page 601, Footnote: Change “Exercise 13.5” to “Exercise 13.25”.
4. Page 615, Line 2: Change “ $\theta$ ” to “ $\theta_1$ ”.
5. Page 643, Exercise 13.12: Change “Example 12.22” to “Example 12.18”.
6. Page 646, Lines 2 and 14: Change “exponentially” to “asymptotically”.
7. Page 646, Exercise 13.25: Change “(13.40)” to “(13.41)”.
8. Page 648, Exercise 13.36, line 3: Change “ $-\epsilon$ ” to “ $+\epsilon$ ”.
9. Page 648, Exercise 13.36, Part (a): Change “the circle of radius  $1/\mu$ ” to “the surface  $x_1^2 + x_2^2/\omega^2 = 1/\mu^2$ ”. At the end of part (a), change “circle” to “surface”.
10. Page 648, Exercise 13.36, Part (c), Line 2: Change “it” to “them”.

## Appendix A to the End

1. Page 652, Line 6: Change “ $f(a + z(a, \lambda))$ ” to “ $f(a, z(a, \lambda))$ ”.
2. Page 662: In the proof of the center manifold theorem, the definition of the set  $S$  should be modified such that the functions  $\eta(y)$  have the additional property that their partial derivatives are Lipschitz in  $y$ . See Appendix C.15 of the third edition. See also the errata sheet of that edition.
3. Page 688, Line 1: Change “ $u(0)$ ” to “ $u(t_0)$ ”.
4. Page 688, Equation (A.44): Change “ $\sigma_{mam}$ ” to “ $\sigma_{max}$ ”.
5. Page 697, Line 15: Change “ $\|\psi_T(y_1 + y^{(2)}) - \psi_T(y_1 + y^{(1)})\|$ ” to “ $\|\psi_T(y_1 + y^{(2)}) - \psi_T(y_1 + y^{(1)})\|^2$ ”.
6. Page 706, Line 14: Change “Section 24A” to “Section 24B”.