Nonlinear Dynamical Systems and Control

Errata and Addenda

Wassim M. Haddad and VijaySekhar Chellaboina
wm.haddad@aerospace.gatech.edu
vijay@atc.tcs.com

April 5, 2010

This document contains an updated list of errata and addenda. Please e-mail us if you discover additional typos or errors, and we will include them in future updates.

- Page xxv, 2nd paragraph, line 1: replace "Heraklitos" with "Herakleitos".
- Page 2, Definition 1.1, statement v): replace statement with "For every $x_0 \in \mathcal{D}, u \in \mathcal{U}$, and $t_0 \in \mathbb{T}$, there exists $y \in \mathcal{Y}$ such that $y(t) = h(t, s(t, t_0, x_0, u), u(t))$ for all $t \in \mathbb{T}$."
- Page 22, Example 2.5: replace "$\mathcal{B}_\varepsilon(0) \subseteq \mathcal{S}$" with "$\mathcal{B}_\varepsilon(x) \subseteq \mathcal{S}$."
- Page 45, 2nd line above Example 2.19: delete statement iii).
- Page 49, Example 2.22: delete the wording "since f' is unbounded in every neighborhood of the origin."
- Page 71, Definition 2.47, statement i): replace "for every $t \in \mathbb{R}$, $s(\cdot, x)$ is continuously differentiable on $\mathcal{D}$." with "for every $x \in \mathcal{D}$, $s(\cdot, x)$ is continuously differentiable on $\mathbb{R}$."
- Page 103, line 20: change "$\mathcal{O}^+_{x_0}$" to "$\mathcal{C}$"
- Page 103, line 22: change "$\mathcal{O}^+_{x_0}$" to "$\mathcal{C}$"
- Page 106, line 4 after Definition 2.54: change "$\mathcal{G}$" to"Γ"
- Page 106, Theorem 2.44: delete the wording "such that there are no equilibrium points of (2.230) and (2.231) in $\mathcal{D}$" and add the wording "other than equilibrium points" at the end of the theorem statement.

- Page 109, Theorem 2.45: delete the wording "such that there are no equilibrium points of (2.230) and (2.231) in $\mathcal{D}$" and add the wording "other than equilibrium points" at the end of the theorem statement.

- Page 117, Problem 2.50, Equation (2.251): replace "$x \in \mathcal{D}$" with "$y \in \mathcal{D}$."

- Page 125, Problem 2.106, line 2 and line 6: change "(2.211)" to "(2.212)"

- Page 130, Problem 2.139: replace Equations (2.287) and (2.288) with

$$\begin{aligned} \text{“}\dot{x}_1(t) &= x_2(t), \quad x_1(0) = x_{10}, \quad t \geq 0, \\ \dot{x}_2(t) &= -x_1(t) + x_2(t)[1 - x_1^2(t) - 2x_2^2(t)], \quad x_2(0) = x_{20}.\text{”} \end{aligned}$$

- Page 130, Problem 2.142, Equations (2.294) and (2.295): change "$[\beta^2 - x_1(t) - x_2^2(t)]^\gamma$" to "$[\beta^2 - x_1^2(t) - x_2^2(t)]^\gamma$"

- Page 150, Example 3.6, line 2: change "notion" to "motion"

- Page 185, Problem 3.16, Equation (3.218): change "$u_i(t)$" to "$-u_i$"

- Page 186, Problem 3.17, Equation (3.220): replace "$\frac{1}{2}(\theta^2 + \dot{\theta}^2)$" with "$\frac{1}{2}(\theta^2 + a\dot{\theta}^2)$"

- Page 195, Problem 3.44, 1st line in hint: replace "positive orbit $\mathcal{O}_x^+$" with "positive limit set $\omega(x)$"

- Page 195, Problem 3.45: replace "$A \in \mathbb{R}^n$" with "$A \in \mathbb{R}^{n \times n}$."

- Page 261, Proposition 4.7, 2nd and 3rd lines: replace "positive orbit $\mathcal{O}_x^+$" with "positive limit set $\omega(x)$" and "$\mathcal{O}_x^+ = \{y\}$" with "$\omega(x) = \{y\}$"

- Page 261, proof of Proposition 4.7, lines 1, 4, and 7: replace "$y \in \mathcal{O}_x^+$" with "$y \in \omega(x)$" and "$\mathcal{O}_x^+ = \{y\}$" with "$\omega(x) = \{y\}$"

- Page 265, Theorem 4.21, line 4: replace "class $\mathcal{K}$ function" with "class $\mathcal{K}_\infty$ function"

- Page 266, line 1: replace "*ii*) holds." with "*ii*) holds with $\alpha(r) = r$."

- Page 319, Problem 4.29, 2nd line in statement *ii*): change "continuous at $(t, 0)$" to "jointly continuous at $(t, 0)$"

- Page 320, 2nd line: change "continuous at $(t, 0)$" to "jointly continuous at $(t, 0)$"
- Page 321, Problem 4.33 line 6: change the set "$\{(x_1, x_2) \in \mathbb{R}^2 : \frac{1}{2}x_1^2 + x_2^2\}$" to "$\{(x_1, x_2) \in \mathbb{R}^2 : \frac{1}{4}x_1^2 + x_2^2\}$"
- Page 321, Problem 4.34: change "$2 \sin 2t$" to "$\sin 2t$"
- Page 321, Problem 4.36, Equation (4.427): change "$4x_1$" to "$4x_1(t)$"
- Page 335, 2nd and 3rd lines in the proof of Theorem 5.3: change "there exists $x \in \mathcal{D}$" to "there exists $x \in \mathcal{D}, x \neq 0$," and replace "$r(u(t), y(t)) = 0$ almost everywhere $t \geq 0$, for all admissible $u(\cdot) \in \mathcal{U}$." with "$r(u(t), y(t)) = 0$ almost everywhere $t \geq 0$, for $u(t) = \kappa(y(t))$".
- Page 345, Equation (5.71): change "$(\frac{\partial \mathcal{H}}{\partial x}(x))$" to "$(\frac{\partial \mathcal{H}}{\partial x}(x))^{\mathrm{T}}$"
- Page 348, 3rd line after Equation (5.85): change "$\ell : \mathbb{R}^n \to \mathbb{R}$" to "$\ell : \mathbb{R}^n \to \mathbb{R}^p$"
- Page 350, LHS of Equation (5.94): change "$y(s)\mathrm{d}s$" to "$y(s))\mathrm{d}s$"
- Page 362, 1st line after Equation (5.163): change "γ^2" to "γ"
- Page 363, line 4: change "Definition 5.19" to "Definition 5.18"
- Page 376, last line before Equation (5.209): change "if" to "it"
- Page 378, line 7: replace "$\sigma_{\mathrm{s}}(y, t) = \sigma(y, t) - M_1(y)$" with "$\sigma_{\mathrm{s}}(y, t) = \sigma(y, t) - M_1 y$"
- Page 386, Figure 5.9: change "Popov slope $= -1/N$" to "Popov slope $= 1/N$"
- Page 394, Equation (5.253): replace "λ" with "1"
- Page 396, Problem 5.34, line 4: replace "Show that the following statements are equivalent:" with "Consider the following statements:" In addition, after Equation (5.261) add "Show that *i*) and *ii*) are equivalent, *iii*) and *iv*) are equivalent, and *i*) (or, equivalently, *ii*)) implies *iii*) (or, equivalently, *iv*))."

- Page 401, line 1: change "$C(q,\dot{q})_{(i,j)} = \sum_{k=1}^{n} \gamma_{ijk}(q)\dot{q}_k$, where $i,j = 1,\ldots,n$" with "$C(q,\dot{q})_{(k,j)} = \sum_{i=1}^{n} \gamma_{ijk}(q)\dot{q}_i$, where $k,j = 1,\ldots,n$"

- Page 405, Problem 5.57, line 1: change "Matheiu" to "Mathieu"

- Page 439, Example 6.5: replace "$\inf_{u\in U}$" with "$\inf_{u\in\mathbb{R}}$"

- Page 492, Proof of Theorem 7.7, lines 5 and 6 in statement i): replace

$$\begin{aligned} \text{“}\leq &\sup_{\omega\in\mathbb{R}} \sigma_{\max}(H(\jmath\omega))\frac{1}{2\pi}\int_{-\infty}^{\infty} u^*(\jmath\omega)u(\jmath\omega)\mathrm{d}\omega \\ = &\sup_{\omega\in\mathbb{R}} \sigma_{\max}(H(\jmath\omega))\|\!|u|\!\|_{2,2}^2, \text{”} \end{aligned}$$

  with

$$\begin{aligned} \text{“}\leq &\left(\sup_{\omega\in\mathbb{R}} \sigma_{\max}(H(\jmath\omega))\right)^2\frac{1}{2\pi}\int_{-\infty}^{\infty} u^*(\jmath\omega)u(\jmath\omega)\mathrm{d}\omega \\ = &\left(\sup_{\omega\in\mathbb{R}} \sigma_{\max}(H(\jmath\omega))\right)^2\|\!|u|\!\|_{2,2}^2, \text{”} \end{aligned}$$

- Page 532, Equation (8.113): change "$x_1(t) + x_1(t)x_2^2(t)$" to "$-x_1(t) + x_1(t)x_2^2(t)$"

- Page 532, Equation (8.116): change "$\frac{1}{2}V'(x))$" to "$\frac{1}{2}V'(x)$"

- Page 532: replace Equation (8.117) with

$$[2x_1\ 2x_2]\begin{bmatrix} -x_1 + x_1x_2^2 \\ -x_2 - 2x_1^2x_2 \end{bmatrix} = -2(x_1^2 + x_2^2 + x_1^2x_2^2) < 0$$

- Page 543, Equation (8.156): change "$\alpha(x(t))$" to "$-\alpha(x(t))$" and "$-\frac{\gamma(x(t))}{2}\beta^{\mathrm{T}}(x(t))\beta(x(t))$" to "$\frac{\gamma(x(t))}{2}\beta^{\mathrm{T}}(x(t))\beta(x(t))$"

- Page 817, 1st line after Equation (13.200): change "γ^2" to "γ"

- Page 943, 3rd column, line 21: replace "theotem" with "theorem"