Errata for "Introduction to the Mathematical Theory of Control"

by A. Bressan and B. Piccoli, AIMS series on Applied Mathematics, 2007

Chapter 2

p.17. In (2.12), the last integral should be

$$\int_{t_0}^{t} \beta(s) \exp\Big(\int_s^t \alpha(\sigma)\,d\sigma\Big)\,ds\,.$$

p.21. In the formula on line 17, the last term should be $\Big(e^{C(t-t_0)} - 1\Big)$.

p.24, line 14. "the function $x(t) = M(t,s)\xi$ provides the solution to the Cauchy problem".

Chapter 3

p.48, line 9. Should be:

$$|f(t,x,u) - f(t,x',u)| \;\leq\; L|x - x'|.$$

p.49, line 6. "in a finite number of steps"

p.49, formula (3.35) should be

$$\big\langle f(t_i, \tilde{x}(t_i), u_i), p_i\big\rangle \;>\; \big\langle f(t_i, \tilde{x}(t_i), \tilde{u}(t_i)), p_i\big\rangle - \frac{\varepsilon L}{3}.$$

p.55. The formula on line 14 should be:

$$t_1 \;=\; \inf\big\{t' < \tau;\; \phi(x(t)) \leq t + \varepsilon(\tau - t) \quad \text{for all } t \in [t', \tau]\big\},$$

removing the factor 2.

p.65. The equation on line 4 from bottom should be

$$\dot{x} \;\in\; F^{\sharp}(t,x) \;=\; \overline{co}F(t,x)$$

Chapter 4

p.75, line 7: "... to design a feedback control $u = u(x)$..."

p.82. The equation on line 8 should be

$$\dot{x} \;=\; (A + B\widetilde{F})x + v_1 u, \qquad u \in I\!R.$$

Chapter 5

p.92. Equation (5.11) should be

$$\dot{x}(t) \;=\; A(t) \cdot x(t) + h(t, u(t)),$$

p.94. A comma is missing in equation (5.19). It should be:

$$F^+(t,x) \;=\; \{(y_0, y) \in I\!R^{1+n};\; y_0 \geq L(t,x,\omega), \quad y = f(t,x,\omega) \text{ for some } \omega \in \mathbf{U}\}$$

Chapter 6

p.106. Line 5 from bottom should be:

$$p_1(t) \;=\; \cos(T-t), \qquad p_2(t) \;=\; \sin(T-t).$$

p.106. Equation (6.22), should be:

$$u^*(t) \;=\; \text{sign}(p_2(t)) \;=\; \text{sign}(\sin(T-t))$$

p.111, the last formula should be: $\dot{v}(t) = D_x f(t, x^*(t), u^*(t))\, v(t)$.

p.115, in formula (6.47), all three limits should have the form $\displaystyle\lim_{\varepsilon\to 0+} \frac{1}{\varepsilon}\int \cdots$

p.119. The statement above (6.72), should be: " This yields a minimization problem ".

p.128, problem 6.3, lines 8, 10, 11. Replace with $(x_1, x_2)(0) = (0, -1)$. Then $\bar{y} = (b, 1)$, and $\hat{y} = (x_1, 1)$. (Notice that in this second case the coordinate x_1 is free).

Chapter 7

p.133. To be consistent with (7.3), the integral in (7.1) should be $\int_{\bar{t}}^{T}$.

p.138. Theorem 7.3.1, part (ii): "then $V(t, x(t, u^*))$ is constant for $t \in [t_0, T]$".

p.140. line 6. In Step **3.** of the proof, the equation should be:

$$\inf_{\omega \in \mathbf{U}} \left\{ \partial_s V(t_\nu, x_\nu(t_\nu)) + \nabla_y V(t_\nu, x_\nu(t_\nu) \cdot f(t_\nu, x_\nu(t_\nu), \omega) \right\} \leq \frac{1}{\nu}.$$

p.140, equation (7.22) should be

$$V(s, y) \doteq \inf_{u \in \mathcal{U}} \left\{ \int_s^T L(t, x(t), u(t))\, dt + \psi(T, x(T))\,; \quad x(s) = y \right\}.$$

p.147, line 12, should be "$y_1 > \varphi(y_2)$.

Chapter 8

p.177. Equation (8.19) should be

$$F(x_\varepsilon, u_\varepsilon(x_\varepsilon), \nabla\psi(x_\varepsilon)) \leq \varepsilon \Delta\psi(x_\varepsilon).$$

p.180, lines 6–8 from bottom:

$$\Phi_\varepsilon(x, y) \leq 0 \qquad\qquad \text{if } |x - y|^2 \geq 4M\varepsilon.$$

Hence (8.28) implies

$$|x_\varepsilon - y_\varepsilon| \leq 2\sqrt{M\varepsilon}.$$

p.182. Equation (8.42) should be:

$$\phi_t(t_\varepsilon, x_\varepsilon) + H(t_\varepsilon, x_\varepsilon, \nabla\phi(t_\varepsilon, x_\varepsilon)) \leq -\frac{\varepsilon}{(T - t_\varepsilon)^2}.$$

p.184, line 4: "takes a minimum at the point $(t_\varepsilon, x_\varepsilon)$."

p.188, lines 11-12: "hence, by (8.54) we deduce

$$J(s, y', u) \leq J(s, y, u) + \int_s^T C e^{C(t-s)} |y' - y|\, dt + C e^{C(T-s)} |y - y'|.$$

p.188. Equation (8.64) should be:

$$V(s,y') \ \leq \ V(s,y) + \varepsilon + (C+1)e^{CT}|y-y'|.$$

p.188. In the first two equations in Step 3, the right hand side should contain $+\ C(s'-s)$, rather than $-C(s'-s)$.

p.192. The second equation in (8.83) should be: $|h(x,u) - h(y,u)| \ \leq \ L|x-y|$.

Appendices

p.281. In the equation (A.30) one should have: $|u-u'| \leq \delta_\varepsilon$.

p.281. Lines 16-17 should be: "By (A.30), the point $y' = f(x',u) \in F(x')$ satisfies $|y'-y| < \varepsilon$".

p.282. Line 3 should be: $\xi = (\xi_1, \cdots, \xi_n)$.

p.282. Line 8 from bottom should be: $\varphi(t_k) = \langle \mathbf{v}, y_k \rangle$.

p.282. Line 6 from bottom should be: $\bar{y} \in F(\tau)$.

p.288, line 5: "choose a sequence of points $x_\nu \notin K$ with $x_\nu \to w$".