Errata: Nonholonomic Mechanics and Control

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This file contains the errata known to us as of the above date for the *first printing* of the 1st edition (2003). These errata will be corrected in the *second printing*.

Introduction

Page 1, Line 11 : Insert a closing parenthesis after "whole" and a comma after "law".

Pages 6,7 Section 1.2 : Interchange a and b in the endpoints of the integrals for consistency.

Page 9, first line of paragraph "Energy and Hamilton's Equations" : There is a missing partial before $\dot{q}_j$.

Page 10, 3rd last line, last displayed equation : Replace Γ_r^{lm} with Γ_{rlm}.

Page 11, 5 lines from bottom : F^i should be F_i.

Page 18, displayed equation lines before displayed equation (1.4.4) : Second equation should have an m before the R^2.

Page 20, equation (1.4.9) : This equation should read

$$J\ddot{\varphi} - R\mu_1\dot{\theta}\sin\varphi + R\mu_2\dot{\theta}\cos\varphi = u_\varphi$$

Page 23, Figure 1.6.1 : Interchange x and y on the axes.

Page 26, Line 8 : J should be I.

Page 27, 8 lines after (1.7.4) : Replace "and one negative eigenvalue" with "together with a negative eigenvalue if $v > 0$ and a positive eigenvalue if $v < 0$."

Page 27, Figure 1.7.2 : Labeling of axes should be interchanged i.e. v and ω should be swapped.

Page 30, Equation (1.8.8) : $xu_2 - yu_1$ should read $yu_1 - xu_2$.

Page 32, First line after second display : Replace x by q, three times.

Page 33, Three lines below equation (1.8.16) : $\dot{z} = x\dot{y} - y\dot{x}$ should be $\dot{z} = y\dot{x} - x\dot{y}$.

Page 34, Lines 4 and 5 : Remove the minus signs in both places.

Page 34, Two lines below (1.8.17) : In the display, ta^2 should be $a/2\pi$.

Page 36, 37 First equation of (1.9.8) and of (1.9.9) : Multiply λ_1 and λ_2 by a. Also, on the first and last line of (1.9.9), $\hat{\omega}$ should be boldface: $\hat{\boldsymbol{\omega}}$.

Page 39, Equation (1.9.21) : Eliminate the extra parenthesis right after K.

Page 45, Displayed equation for H above (1.12.1) : The parenthesis at the end of this line should not be a subscript; i.e. $x_{k+1)}$ should be x_{k+1}).

Page 46, Displayed equation for B below (1.12.6) : In the last row of the matrix B, a_{n-1} should be $-a_{n-1}$

Chapter 2

Page 59, first line of Proposition 2.1.9 : (M) should be (U).

Page 60, fifth line from the bottom : "level set of X" should be " level set of f"

Pages 63, 64 : various occurrences of "ϕ" should be "φ" to be consistent with the figure.

Page 64, Paragaph in middle : The title of the paragraph should be "Level Sets as Differentiable Manifolds in $\mathbb{R}^n$.

Page 68, equation (2.2.1) : After $Df(u)$ there should be a $\cdot$ not a comma.

Page 74, title of section 2.4 : Title should be "Center Manfolds" and the words "Theory and the Lyapunov-Malkin Theorem" should be removed from the first line of the section.

Page 75, Theorem 2.4.3 should read : *Suppose that the zero solution of* (2.4.3) *is stable* (*resp. asymptotically stable*) *and that the eigenvalues of A are in the left half-plane. Then the zero solution of* (2.4.1, 2.4.2) *is stable* (*resp. asymptotically stable*). *If either the zero solution of* (2.4.3) *is unstable, or if any eigenvalues of A are in the right half plane, then the zero solution of* (2.4.1, 2.4.2) *is also unstable.*

Page 78: Exercise 2.4.1 In the first line of displayed equation, y^2 should be xy. There is a similar correction in the caption of the accompanying figure 2.4.2.

Page 85, 4th line of exercise 2.5-2 : x, y, z should all in the denominator with with ∂.

Page 87, 2nd last line : "Jacobi Lie bracket" repeated (index problem).

Page 91, item number 14 : $x, x_1, \ldots, x_k$ should be $X, X_1, \ldots, X_k$. Also, the summation on the index i should start at 1, not zero.

Page 92: Exercise 2.6-1 : There is a lettering problem: remove the (a) (this is not an exercise). Then (b) should be (a) as so on. Also the β is the current part (e) should α.

Page 98: Two lines above Definition 2.8.5 : "The by lemma..." should read "Thus, by the preceding lemma,..."

Page 99, two lines after (2.8.1) : "if and if only if" should be "if and only if"

Page 100, End of first paragraph : $\mathrm{SO}(n)$ should be $\mathfrak{so}(n)$.

Page 103, Definition 2.8.13 : Rewrite the definition as follows: *Suppose* $\Phi : G \times M \to M$ *is an action. For* $\xi \in \mathfrak{g}$, *the map* $\Phi^\xi : \mathbb{R} \times M \to M$ *defined by* $\Phi^\xi(t, x) = \Phi(\exp(t\xi), x)$

is an $\mathbb{R}$-action—that is, a flow—on M. The vector field on M that generates this flow, namely

$$\xi_M(x) = \left.\frac{d}{dt}\right|_{t=0} \Phi^\xi(t,x)\,. \tag{2.8.3}$$

is called the ***infinitesimal generator*** *of the action corresponding to ξ.*

Page 105, Defn 2.9.1 (ii) second line : insert a comma after U_k.

Page 112, 12th line : Middle term in curly parentheses should have g_{lk} not g_{ik}.

Chapter 3

Page 122: Last displayed formula : P_i should be p_i.

Page 137: Line after (3.7.5) : $\xi_Q(q^i)$... should be $\xi_Q(q)$....

Page 143: 4 lines after displayed equation (3.9.5) : Delete the minus sign in front of $\nabla \times \mathbf{A}$.

Page 146: equation (3.10.18) should read as follows (swap the arguments on the right hand side):

$$\begin{aligned}
\mathrm{ver}_q v = [\mathcal{A}(q,v)]_Q(q) &= \left(\dot{s} - \frac{\beta}{\gamma}\cos\theta\dot{\theta}, 0\right), \\
\mathrm{hor}_q v = v - \mathrm{ver}_q v &= \left(\frac{\beta}{\gamma}\cos\theta\dot{\theta}, \dot{\theta}\right)
\end{aligned}$$

and the A at the end of the example should be $\mathcal{A}$.

Page 162, equation (3.13.11) : Last term in square brackets should be squared; i.e. $||\dot{\mathbf{r}}_1||^2$.

Chapter 4

Page 180, Line below (4.2.7) : Delete the duplicate appearance of $[g_2,[g_1,f]](\mathbf{\Omega})$.

Page 205, equation (4.6.18) : Delete the last parenthesis.

Chapter 5

Page 217, two lines before(5.2.3) : Instead of "choose, in a neigborhood of each point, a local coordinate chart..." put rather "choose local coordinates"

Chapter 7

Page 331, line after (7.1.4) : One "of" should be deleted.

Page 343, Assumption (ii) : Replace "The dimension of D_F is" by "The dimension of the distribution D_F defined by the span of $X_1,\ldots,X_k$ is"

Chapter 8

Page 392, Line following equation (8.6.1) : $p = I_{ab}\omega^b$ should be $p_a = I_{ab}\omega^b$.

Chapter 9

Page 403, equation (9.2.2) and the following displayed equation : λ^2 should be λ_2 and $\frac{1}{2}l_3^2$ should be $\frac{l_3^2}{2J_3}$.

Page 403, fourth line from the bottom : Π_2 should be Π_3.

Page 405, tenth line : Close parentheses after "below".

Bibliography

Page 440, Appell 1911 reference : "lews" should be "les",

Page 444 : Add [1985] to the Burke reference.

Page 452, Helmke reference : Authors in the reference should be Hemlke, U. and J. Moore.

Page 463, Rumiantsev 1966 reference : Valentin should be V. for consistency.

More References : See the book's website http://www.cds.caltech.edu/mechanics_and_control/ for additional bibliography