Errata

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Errata

Changes appear in yellow. Line $k+$ (resp., line $k-$) denotes the kth line from the top (resp., the bottom) of a page.

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Page 19. Problem 1.26, second item: $y(x_0+x) = y(x_0 - x)$

Page 28. Third paragraph: Second, we can extend the notion of a super solution by requiring only $\dot{x}_+(t) \geq f(t, x_+(t))$.

Page 30.

$$\dot{\psi}(t,x) = \big(1 - 2\phi(t,x)\big)\psi(t,x) - \big(1 - \sin(2\pi t)\big). \tag{1.80}$$

Page 38. Theorem 2.2: $\bar{x}(t) \in C^1(I, \mathbb{R}^n)$, Lemma 2.3: $\bar{x}(t) \in C^{k+1}(I, \mathbb{R}^n)$

Page 40.

$$\sup_{t_0 \le t \le t_0+T_0} |\overline{x}(t) - K^m(x_0)(t)| \le \frac{L_1(T_0)^m}{m!} \mathrm{e}^{L_1(T_0)} \int_{t_0}^{t_0+T_0} |f(s,x_0)| ds. \qquad (2.28)$$

Page 45. 10+: $\Delta(t) = |\phi(t,t_0,y_0) - \phi(t,s_0,y_0)|$ and use ...

Page 51. Theorem 2.13: Suppose the IVP (2.10) has a unique local solution for every $(t_0,x_0) \in U$

Page 57. 4+: Taking $m \to \infty$ we finally obtain

Page 62.

$$\exp(tJ) = \exp(\alpha t \mathbb{I}) \exp(tN) = \mathrm{e}^{\alpha t} \sum_{j=0}^{k-1} \frac{t^j}{j!} N^j. \qquad (3.18)$$

Page 64. Proof of Lemma 3.3; We are looking for generalized eigenvectors u_k such that $\exp(N) u_k = u_k + u_{k-1}$, that is,

$$\sum_{l=j+1}^{n} \frac{1}{(l-j)!} u_{k,l} = u_{k-1,j}, \qquad 1 \le k \le n,\ 1 \le j \le n,$$

with $u_0 = 0$.

$\vdots$

$$\sum_{k=j}^{n} S(l,k) s(k,j) = \delta_{j,l}, \qquad 1 \le j,l \le n.$$

Then, by construction, $U^{-1} \exp(N) U = \mathbb{I} + N$ and the claim follows.

Page 73. Problem 3.13: It should read $\deg(q(t)) \le \deg(p(t)) + s$ where s is the size of the largest Jordan block corresponding to the eigenvalue β. Moreover, here is an extended hint:

(Hint: Investigate (3.48) using the following fact: $\int^t (t-s)^m p(s) \mathrm{e}^{\beta s} ds = q(t) \mathrm{e}^{\beta t}$, where $q(t)$ is a polynomial of degree $\deg(q) = \deg(p) + m$ if $\beta \ne 0$ and $\deg(q) = \deg(p) + m + 1$ if $\beta = 0$. To see this differentiate $\int^t s^k \mathrm{e}^{\beta s} ds$ with respect to β.)

Page 84. Line before (3.98): Let $X(t)$ be the identity matrix with the first column replaced by $\phi_1(t)$,

Page 89. Example:

$$\big(\mathrm{e}^{t^2} \ddot{c}(t) + 4t\mathrm{e}^{t^2} \dot{c}(t) + (2+4t^2)\mathrm{e}^{t^2} c(t)\big) - 2t\big(\mathrm{e}^{t^2} \dot{c}(t) + 2t\mathrm{e}^{t^2} c(t)\big) - 2\mathrm{e}^{t^2} c(t)$$

Page 90. Problem 3.34: Consider the equation $\ddot{x} + q_0(t) x = 0$.

Page 90. Problem 3.37:

$$y(t) = Q(t)^{-1} x(t), \qquad Q(t) = \mathrm{e}^{-\frac{1}{n}\int^t q_{n-1}(s)ds}.$$

$$y^{(n)} + Q(t)^{-1} \sum_{k=0}^{n-2} \sum_{j=k}^{n} \binom{j}{k} q_j(t) Q^{(j-k)}(t) y^{(k)} = 0,$$

Page 90. Problem 3.38:

$$\dot{y} + \mathrm{e}^{-Q(t)} y^2 + \mathrm{e}^{Q(t)} q_0(t) = 0.$$

Page 100. Paragraph after the proof of Theorem 3.23: ...is constant. To this end recall that Corollary 3.5 tells us when the system corresponding to $B(t) = 0$ is stable . Moreover, ...

Page 101. Theorem 3.26:

$$|x(t)| \le C\mathrm{e}^{-(\alpha - b_0 C)t} |x_0|, \qquad |x_0| < \frac{\delta}{C},\ t \ge 0. \tag{3.168}$$

Page 106. Take

$$U = ((A-\alpha)^{n-1}u, \dots, (A-\alpha)u, u), \tag{3.191}$$

Page 108. Lemma 3.34: Moreover, if A is real and all Jordan blocks corresponding to negative eigenvalues come in pairs, then there is a real logarithm.

Also adapt the first paragraph of the proof according to: Since the eigenvalues of A^2 are the squares of the eigenvalues of A (show this), it remains to show that B is real if all Jordan blocks corresponding to negative eigenvalues come in pairs. In this respect note that a pair of Jordan blocks J, J corresponding to a negative eigenvalue can be regarded as a pair J, J^* of complex conjugate blocks and hence is covered by the analysis below (as the case $\varphi = \pi$).

Page 117. Lemma 4.4: In this case we have $\alpha = -\lim_{z\to 0} z\, p(z)$ and the radius of convergence for the Laurent series of $p(z)$ equals the radius of the largest ball on which $h(z)$ is analytic and nonzero.

Page 120. Proof of Theorem 4.5: An argument that $h_2(z)$ has the same radius of convergence is missing:

If there is a second solution of the form $u_2(z) = z^{\alpha_2} h_2(z)$ the same argument can be used for $h_2(z)$. Otherwise one has to use (4.56) below in place of (4.39).

It is also possible to use $u_2(z) = c(z)u_1(z)$ with

$$c'(z) = z^{-2\alpha_1 - p_0} h_1(z)^{-2} \exp\left(-\int^z \tilde{p}(z)\right) = u_1(z)^{-2} \exp\left(-\int^z p(z)\right),$$

where $\tilde{p}(z) = p(z) - \frac{p_0}{z}$ is the analytic part of $p(z)$ near 0. However the primitive $c(z)$ might have logarithmic terms at a zeor z_0 of $u_1(z)$. A computation shows

$$c'(z) = \frac{\exp\left(-\int^{z_0} p(z)\right)}{u_1'(z_0)^2}\left(\frac{1}{(z-z_0)^2} + \frac{u_1''(z_0) + p(z_0)u_1'(z_0)}{z - z_0} + \cdots\right)$$

and since $u_1''(z_0) + p(z_0)u_1'(z_0) = 0$ we conclude that c has a first order pole at z_0 which will be removed by $u_1(z)$.

Alternatively, note that the present theorem will also follow as a special case of Theorem 4.13.

Page 123.

$$h_{1,2j} = \frac{(-1)^j}{4^j j!(\nu+1)_j}, \qquad h_{1,2j+1} = 0, \tag{4.64}$$

Page 124.

$$h_{2,2j} = \frac{1}{4^j j!(n-j)_j}, \qquad j < n. \tag{4.69}$$

Page 124.

$$\begin{aligned} Y_n(z) = &-\frac{2^n(n-1)!}{\pi}u_2(z) + \frac{\gamma - \log(2)}{2^{n-1}\pi n!}u_1(z) \\ =&\frac{2}{\pi}(\gamma + \log(\frac{z}{2}))J_n(z) - \frac{1}{\pi}\sum_{j=0}^{n-1}\frac{(-1)^j(n-j-1)!}{j!}\left(\frac{z}{2}\right)^{2j-n} \\ &- \frac{1}{\pi}\sum_{j=0}^{\infty}\frac{(-1)^j(H_{j+n}+H_j)}{j!(j+n)!}\left(\frac{z}{2}\right)^{2j+n} \end{aligned} \tag{4.75}$$

Page 126. Problem 4.5: $\Gamma(z) = \frac{(-1)^n}{n!(z+n)} + O(1)$.

Page 126. Problem 4.8:

$$h_j = -\frac{1}{j}\sum_{k=0}^{j-1} p_{j-k}h_k,$$

Page 127. Problem 4.10: For (i) you can use that $\Gamma(z)$ has no zeros and hence $\Gamma(z)^{-1}$ is an entire function.

Page 127. Problem 4.11 (iii): $J_{\nu+1}(z) - J_{\nu-1}(z) = -2J_\nu'(z)$

Page 137. Last paragraph: For all eigenvalues α of A_0 for which $\alpha + j$ is not an eigenvalue for all $j \in \mathbb{N}$,

Page 138. Theorem 4.11: If $A(z)$ has a simple pole at $z_0 = 0$ with residue A_0, then there is a fundamental system of solutions of $w' = A(z)w$ of the form

Page 145. Problem 5.3: We have $x \in [0,1]$ and there is only one boundary condition $u(t,1) = 0$.

Page 145. Problem 5.5:

$$m\frac{d^2}{dt^2}u(t,n) = -k(u(t,n+1)-u(t,n))-k(u(t,n-1)-u(t,n)),$$

Page 154.

$$y(x) = y(x_0)c(z,x,x_0) + p(x_0)y'(x_0)s(z,x,x_0) - \int_{x_0}^{x} s(z,x,t)g(t)r(t)dt. \quad (5.50)$$

$$s(z,x,x_0) = \frac{-u(x)v(x_0)+u(x_0)v(x)}{W(u,v)}. \quad (5.51)$$

Page 155. Problem 5.13:

$$Q(y) = \frac{q(x(y))}{r(x(y))} - \frac{(p(x(y))r(x(y)))^{1/4}}{r(x(y))}\big(p(x(y))((p(x((y))r(x(y)))^{-1/4})'\big)'.$$

Page 162. Lemma 5.12:

$$\min_{x\in[a,b]}\frac{q(x)}{r(x)} \le E_0. \quad (5.77)$$

And accordingly in the proof if Lemma 5.12: Then we have $Q(f) \ge \min_{x\in[a,b]}\frac{q(x)}{r(x)}\|f\|^2$ and hence (5.73) implies $Q(u_j) = E_j \ge \min_{x\in[a,b]}\frac{q(x)}{r(x)}$.

Page 162. Proof of Lemma 5.13: for $q_0 < \min_{x\in[a,b]}\frac{q(x)}{r(x)}$.

Page 166. Problem 5.22: with $f^{(2j)}(0) = f^{(2j)}(1) = 0$ for $0 \le j \le k$.

Page 168. In fact, $\theta_b(\lambda,x)$ as defined in (5.89) is the Prüfer angle for $-u_b(\lambda,x)$, but this will be of no importance for our purpose.

Page 169.

$$\#_{(-\infty,\lambda)}(L) = \left\lceil\frac{\theta_a(\lambda,b)-\beta}{\pi}\right\rceil = \left\lceil\frac{\alpha-\theta_b(\lambda,a)}{\pi}\right\rceil - 1, \quad (5.91)$$

Moreover, note that we also have:

$$\#_{(-\infty,\lambda]}(L) = \left\lfloor\frac{\theta_a(\lambda,b)-\beta}{\pi}\right\rfloor + 1 = \left\lfloor\frac{\alpha-\theta_b(\lambda,a)}{\pi}\right\rfloor,$$

Page 172. Replace "As in the case of Theorem 5.18 one proves" by "As an immediate consequence of Lemma 5.16 we obtain"

Page 174. Problem 5.29: suppose $0 \le \alpha_2 < \alpha_1 < \pi$ and show

Page 175. Problem 5.30:

$$W'(u_0, u_1) = (q_1 - \lambda_1 r_1 - q_0 + \lambda_0 r_0) u_0 u_1 + \left(\frac{1}{p_0} - \frac{1}{p_1}\right) p_0 u_0' p_1 u_1'. \qquad (5.111)$$

Page 175. Problem 5.31:

$$u'(x) = a\left(\frac{\cos(x+b)}{x^{1/2}} + \frac{(-3/4 - \nu^2)\sin(x+b)}{2x^{3/2}} + O(x^{-5/2})\right).$$

Page 177. Proof of Lemma 5.29: Then $q - \lambda r > 0$ and any positive solution u of (5.43) with $z = \lambda$ satisfies $(pu')' = (q - \lambda r)u > 0$.

Page 183. Problem 5.33:

$$G_\pm(z, x, y) = \frac{W(z)^{-1}}{1 \mp \rho_+(z)} \begin{cases} u_+(z,x)u_-(z,y) \pm \rho_+(z) u_-(z,x)u_+(z,y), & y < x, \\ u_-(z,y)u_+(z,x) \pm \rho_+(z) u_+(z,y)u_-(z,x), & y > x, \end{cases}$$

with $W(z) = W(u_+(z), u_-(z))$.

Page 184. Problem 5.35: (iii) $c(z,\ell) = s'(z,\ell)$.

Page 190. 9+: Furthermore, $K^{j+1} \in C^k(U_j, M)$ for any

Page 192. First paragraph of Section 6.3: Otherwise x is called **regular** and $\Phi(.,x) : I_x \hookrightarrow M$ is an immersion.

Page 195. Replace the 3rd line in the Example by:
Since $|f(x)| \le \sqrt{2}(1 + |x|)$ the vector field is complete by Theorem 2.17. The zeros are

Page 204.

$$\operatorname{sign}(x_1) \int_{x_0}^{x} \frac{d\xi}{\sqrt{2(E - U(\xi))}} = t, \qquad E = \frac{x_1^2}{2} + U(x_0). \qquad (6.47)$$

Page 207. Problem 6.24:

$$\frac{\partial}{\partial t} u(t,x) + \frac{\partial^3}{\partial x^3} u(t,x) + 6u(t,x)\frac{\partial}{\partial x} u(t,x) = 0$$

Page 208. Problem 6.25 should be changed according to:

Show that if $\{(\dot{x}, x) \in M | E(\dot{x}, x) = E_0\}$ is compact and contains no fixed point, then it corresponds to a periodic orbit. Conclude that all solutions are periodic if $\lim_{|x|\to\infty} U(x) = +\infty$ and U has a unique minimum.

Page 211 and 212. Thy y axes in Figure 7.2 and Figure 7.3 are placed incorrectly. They should be on the left, such that all orbits are in the first quadrant.

Page 213. Proof of Theorem 7.4: Exchange the definitions of Q_3 and Q_4.

Page 214. Problem 7.4: The trajectory enters Q_3 and satisfies $x(t) < x_0$ in Q_3 since ... where $y(t)$ decreases, implying $x(t) > x_1 = \frac{1-y_1}{\lambda}$ when .... If $y_2 \geq y_0$, that is, if

$$\lambda\mu^2((\mu\lambda)^2 - 1)(x_0 - \frac{1+\mu}{1+\mu\lambda}) > 0, \tag{1}$$

Page 218. Paragraph after (7.28): Clearly, for y_0 sufficiently small we have $\Delta(y_0) > 0$.

Page 222. The proof of Lemma 7.13 only shows that $\omega_\sigma(x)$ contains a regular periodic orbit. However, the claim follows from Lemma 7.14 if $\omega_\sigma(x)$ is connected. Moreover, connectedness follows from compactness as in the proof of Lemma 6.6. In particular, the connectedness assumption in Theorem 7.16 is superfluous.

Page 225. First equation in the example:

$$f(x,y) = \begin{pmatrix} y \\ -\eta E(x,y)^2 y - U'(x) \end{pmatrix},$$

Page 231. Sentence before (8.9): Moreover, for any positively invariant neighborhood $U \subseteq W^+(\Lambda)$ of Λ we have

Page 233. Problem 8.2: Let $V_R = \{x \in M | L(x) < R\}$ be a relatively compact set

Page 235. Replace the last sentence by: Using the Routh–Hurwitz criterion one can show that the two new fixed points are asymptotically stable for $1 < r < \frac{\sigma(3+b+\sigma)}{\sigma-b-1}$ if $1 + b < \sigma$ and $1 < r$ if $1 + b \geq \sigma$. For the classical values $\sigma = 10$, $b = 8/3$ this gives $1 < r < 470/19 = 24.74$.

Page 239 after (8.34): where $r(t_0) = r(t_1) = 0$, we see that a necessary condition for q to be extremal is that

Page 240.

$$\frac{d}{dt}\begin{pmatrix} p \\ q \end{pmatrix} = +\mathrm{grad}_s H(p,q), \tag{8.46}$$

Page 242. Problem 8.12 should be changed to:

The Lagrangian of a relativistic particle in an external force field is given by

$$L(v,q) = -mc^2\sqrt{1 - \frac{v^2}{c^2}} - U(q),$$

where c is the speed of light, m the (rest) mass of the particle, and U the potential of the force field. Derive the equation of motions from Hamilton's principle. Derive the corresponding Hamilton equations.

Page 244.

$$(P, Q) = (-\frac{\partial S_1}{\partial Q}(q, Q(p, q)), Q(p, q)). \tag{8.63}$$

Page 246.

$$H(p, q) = \frac{1}{2}(pM^{-1}p + qWq) \tag{8.77}$$

Page 246. Line before equation (8.78). Then the symplectic transform $(P, Q) = (V^T M^{-1/2} p, V^T M^{+1/2} q)$ (Problem 8.15) gives the decoupled system

Page 246.

$$H(p, q) = \sum_{j=1}^{n} \frac{p_j^2}{2m} + \sum_{j=0}^{n} U_0(q_{j+1} - q_j), \quad q_0 = q_{n+1} = 0, \tag{8.81}$$

Page 246. In order to better explain what Problem 8.18 is about, the text between "If we assume that the particles ... of the Jacobian matrix of the potential." should be replaced by:

If we assume that the particles are coupled by springs, the potential would be $U_0(x) = \frac{k}{2}x^2$, where $k > 0$ is the so called spring constant, and we have a harmonic oscillator with

$$M = m\mathbb{I}, \qquad W = k \begin{pmatrix} 2 & -1 & & & \\ -1 & 2 & \ddots & & \\ & \ddots & \ddots & \ddots & \\ & & \ddots & 2 & -1 \\ & & & -1 & 2 \end{pmatrix}.$$

The motion is decomposed into n modes corresponding to the eigenvectors of W, which are given by

$$v^j = \sqrt{\frac{2}{n+1}} \begin{pmatrix} \sin(\eta_j) \\ \sin(2\eta_j) \\ \vdots \\ \sin(n\eta_j) \end{pmatrix}, \qquad \eta_j = \frac{\pi j}{n+1}.$$

The corresponding eigenvalues are $m\omega_j^2$, where $\omega_j^2 = \frac{2k}{m}(1 - \cos(\eta_j)) = \frac{4k}{m}\sin(\frac{\eta_j}{2})^2$. Consequently the j'th mode corresponds to the initial condition $(p(0), q(0)) = (0, v^j)$ and is given by

$$q^j(t) = \cos(\omega_j t)v^j, \qquad p^j(t) = -m\omega_j \sin(\omega_j t)v^j.$$

The energy of the j'th mode is $H(p^j, q^j) = \frac{m\omega_j^2}{2}$.

Page 247. Problem 8.16: Ignore the hint.

Page 249.

$$\frac{T}{2} = \frac{\mu}{l_0} \int_{r_-}^{r_+} \left(\left(\frac{1}{r} - \frac{1}{r_+} \right) \left(\frac{1}{r_-} - \frac{1}{r} \right) \right)^{-1/2} dr = \pi \sqrt{\frac{\mu}{\gamma}} \left(\frac{p}{1 - \varepsilon^2} \right)^{3/2}, \quad (8.97)$$

Page 257. Bottom of the page: The requirement $x \in U(x_0)$ could be made part of the definition of $M^{\pm,\alpha}$. Then the intersection with $U(x_0)$ can be dropped at various later points.

Page 259. Theorem 9.3: there are neighborhoods $U(x_0)$ of x_0 and U of 0 and a function $h^{+,\alpha} \in C^k(E^{+,\alpha} \cap U, E^{-,-\alpha})$ such that

Page 261. Theorem 9.4: there are neighborhoods $U(x_0)$ of x_0 and U of 0 and functions $h^{\pm} \in C^k(E^{\pm} \cap U, E^0 \oplus E^{\mp})$ such that

Page 261. Theorem 9.5: Delete equation (9.22) from the statement and add the following remark after the theorem:

Note that while we always have $M^{\pm}(x_0) \subseteq W^{\pm}(x_0) \cap U(x_0)$, equality might not hold even in the case of a hyperbolic fixed point. In fact, $W^{\pm}(x_0)$ might also contain points from $M^{\mp}(x_0)$ as the example of a homoclinic orbit shows.

Page 262. Theorem 9.6: there are neighborhoods $U(x_0)$ of x_0 and U of 0 and functions $h^{\pm} \in C^k(E^{\pm} \cap U \times \Lambda, E^0 \oplus E^{\mp})$ such that

Page 265. After (9.32): We will investigate this equation in the Banach space of bounded continuous functions $C(\mathbb{R}^n, \mathbb{R}^n)$ with the sup norm.
(Remark: Also the notation $C_b(\mathbb{R}^n, \mathbb{R}^n)$ might be more appropriate here.)

Page 266. Proof of Lemma 9.7: The equation $A^{-1} \circ \varphi \circ \vartheta = \varphi \circ \vartheta \circ A^{-1}$ should read $f \circ \varphi \circ \vartheta = \varphi \circ \vartheta \circ f$. This last equation implies $\varphi \circ \vartheta = \mathbb{I} + l$, where l is a solution of $Ll(x) = g(x) - g(x + l(x))$. Using the estimates for the inverse of L and for g one obtains $l \equiv 0$ and thus φ is a homeomorphism.

Page 268. The very last equation on the bottom of the page is only true if Φ_t is linear. Set $\Phi_t = \mathrm{e}^{tA} + G_t$, where G_t is bounded, and replace this equation by

$$h_t = \Phi_t \circ \varphi \circ \mathrm{e}^{-tA} - \mathbb{I} = \mathrm{e}^{tA} \circ h \circ \mathrm{e}^{-tA} + G_t \circ \varphi \circ \mathrm{e}^{-tA},$$

where both terms are bounded.

Page 268.

$$\varphi(x) = (x_1 + x_2^2, x_2). \quad (9.38)$$

Page 270, Problem 9.13: and that $\mathbb{I} - A$ is invertible if $\|A\| < 1$

Page 273.

$$C_\delta = \{B_\delta(k(t, \lambda)) \,|\, (t, \lambda) \in [-T, T] \times \Lambda\} \subset V \quad (9.52)$$

Page 275. κ should be a matrix and $|\kappa|$ should be read as the corresponding matrix norm.

Page 286. Line before (10.19) which is zero at p, positive for $x \neq p$, whose level sets $S_\delta = \{x \in U(p) | L(x) \leq \delta\}$ are connected for sufficiently small δ, and such that $x \in U(p)$ implies $f^n(x) \in U(p)$ and

Page 288.

$$x(m) = \Pi(m, m_0)x_0 + \sum_{j=m_0}^{m-1} \Pi(m, j+1)g(j), \tag{10.28}$$

$$x(m) = \Pi(m, m_0)x_0 - \sum_{j=m-1}^{m_0} \Pi(m, j+1)g(j), \quad m < m_0. \tag{10.29}$$

Page 290. Theorem 10.5: there are neighborhoods $U(p)$ of p and U of 0 and functions $h^\pm \in C^k(E^\pm \cap U, E^0 \oplus E^\mp)$ such that

Page 298. Second sentence after (11.10): Change W^s to W^+.

Page 298. Third paragraph: A map f as above is called **topologically transitive** if for any given nonempty open sets $U, V \subseteq M$ there is an $n \in \mathbb{N}$ such that $f^n(U) \cap V \neq \emptyset$.

Page 300. Sentence after (11.14): Moreover, each of the intervals $I_{n,j} = [\frac{2j}{2^n}, \frac{2j+1}{2^n}]$ is mapped ...

Page 300. Problem 11.3: The assumption that the set has no isolated points needs to be added.

Page 301. Paragraph after (11.19): Moreover, since the endpoints of the subintervals of Λ_n are just given by ${T_\mu}^{-n}(\{0, 1\})$, we see ...

Page 306. Lemma 11.10: the number of periodic points of period at most l is equal to $\mathrm{tr}(A^l)$.

Page 308. Problem 11.10: the number of periodic orbits of period at most n.

Page 311. Theorem 11.20: The Hausdorff dimension of the repeller Λ of the tent map T_μ for $\mu > 2$ is

Page 316. Problem 11.13: It seems too difficult to give a counterexample. The problem should be ignored.

Page 318. Line after (12.7): $M_{x_0}(t_0) = \exp(TQ_{x_0}(t_0)) = \frac{\partial \Phi_T}{\partial x}(\Phi(t_0, x_0))$

Page 323. Theorem 12.9: Delete equation (12.25) from the statement.

Page 324. Problem 12.1:

$$\dot{x} = -y + \big(\mu + \sigma(x^2 + y^2)\big)x, \qquad \dot{y} = x + \big(\mu + \sigma(x^2 + y^2)\big)y$$

Page 324.

$$\Delta(q,\varepsilon) = \Phi(\tau(q,\varepsilon),(0,q),\varepsilon) - q. \tag{12.31}$$

Page 335. Change W^s to W^+ and W^u to W^- in the picture and the text before the picture.

Page 339.

$$\begin{aligned} M(t) &= \int_{-\infty}^{\infty} p_0(s)\,(\delta p_0(s) + \gamma\cos(\omega(s-t)))\,ds \\ &= \frac{4\delta}{3} - \sqrt{2}\pi\gamma\omega\,\mathrm{sech}(\frac{\pi\omega}{2})\sin(\omega t). \end{aligned} \tag{13.26}$$

Thus the perturbed Duffing equation is chaotic for ε sufficiently small provided

Page 339. Problem 13.3:

$$\dot{q} = p, \qquad \dot{p} = -\sin(q) + \varepsilon\sin(t).$$