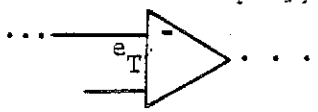
## 3a. ERRATA

The following have been noted so far. The author would be grateful if further corrections were communicated to him (Durand 117, Stanford, CA 94305, USA). Convention: line k- will mean the k-th line from the bottom of the page.

| | Location | Corrected Form |
|---|---|---|
| Chapter 1 | p. 11:line -2 | ..., $t > 0$- |
| | p. 27:Exer. 1.3-5 | ... $v(t) = \exp -3\|t\|$, ... |
| | | ... $w(t) = \frac{\exp -3t}{12} + (3/4) \exp t$ ... |
| Chapter 2 | p. 34:line -13 | [the external ... |
| | p. 34:line -14 | ... in the output], |
| | p. 49:Fig. 2-1-14(b) |  |
| | p. 74:Exer. 2.2-13 | ... between the matrices $A_c$ and $A_o$ of the controller ... |
| | p. 112:Exer. 2.3-7 | This exercise is best postponed to Sec. 3.5. |
| | p. 113:line 3 | ... $\int_0^{\infty} t^{i+1} h(t)\, dt$ |
| | p. 114:Exer. 2.3-16. | Part c. should be postponed to Sec. 2.4.3. |
| | p. 115:Exer. 2.3-23 | $x = [A^{n-1}b$ ... |
| | p. 118:Exer. 2.3-30b. | ... $= -[h_{n+1} \ldots h_{2n}]'$ |
| | p. 120:Exer. 2.3-34 | It appears one adder should be allowed in the design. |
| | p. 128:line -15 | Example 2.4.6 in ... |
| | p. 129:Fig. 2.4-3 | $M[1,n-1]$ (in 3 places) |
| | p. 143:line 16 | ... $\Big\|_{z=0}$ |
| | p. 143:Eq. (30) | $\begin{bmatrix} \mathcal{A}_- & 0 \\ \mathcal{A}_+ & \tilde{\mathcal{B}} \end{bmatrix}$ |
| | p. 157:Exer. 2.4-10b. | ... and $Xb = 0$ ... |
| | p. 158:Exer. 2.4-12b. | should be postponed until after Sec. 3.2. |
| | p. 159:Exer. 2.4-19b. | ... identity $\mathcal{B} =$ |
| | p. 173:line -1 | ... is $c(A - \lambda_1 I)(A - \lambda_2 I)b$. |
| | p. 173:line -2 | ... is $c(A - \lambda_1 I)b$. |
| | p. 174:line -1 | The hint should go with Exer. 2.5-12. |
| | p. 181:Exer. 2.6-2 | $[I - A' \otimes A']p = q$ |
| | p. 182:Exer. 2.6-3 solution to part c. | $V_3 \geq 0$, $\dot{V}_3 = -4[3x_1^2 + 5x_1x_2 + 2x_2^2] < 0$, so cannot conclude anything about stability. |
| Chapter 3 | p. 196:Exer. 3.1-3 | .., provided $-\beta\omega_0^2 < \alpha < \beta$, $\beta > 0$. |

| | | |
|---|---|---|
| Chapter 3 | p. 196:Exer. 3.1-4 | ... $G_c(s) = (13s + 1)/(s + 1)$ ... to find $G_f(s)$ ... |
| | p. 209:Exer. 3.2-4. | In part a., $\xi(s)$ should be written $\xi(\cdot)$ (the time function). So also for the first $\xi(s)$ in part b. |
| | p. 234:Exer. 3.4-7 | where $\bar{A} = A - bk$, $k = \ldots$ ... $\bar{P}_s$ is the only stabilizing and ... |
| | p. 235:Exer. 3.4-9b. | $= \tilde{a}(s)\tilde{a}(-s)(-1)^n$ |
| | p. 236:Exer. 3.4-14 | ... both sides by $b'(-sI - A')^{-1}$ ... |
| | p. 237:Exer. 3.4-16 (last line) | ... (cf. [38] and ... ). |
| | p. 239:footnote | ... diag{$\bar{A}$,N}, $\bar{A}$ nonsingular, N nilpotent. |
| | p. 253:figure | there should be a gain of -1 in the feedback loop |
| | p. 254:Exer. 3.5-6b | ... so that $x(2) = 0$ ... |
| Chapter 4 | p. 264: | Eq. (10): change $\mathcal{C}_-^{-1}$ to $\mathcal{C}_-^{-T}$ |
| | | Eq. (12): change $\mathcal{C}_-^{-T}$ to $\mathcal{C}_-^{-1}$ |
| | p. 264:line 12 | ... $\mathcal{C}_-^{T}$ is an ... |
| | :line 21 | $\ell' = (\alpha - a)\mathcal{C}_-^{-T}$ ... |
| | p. 268:Exer. 4.1-8 | ... position perturbation. ... Also change all n to $\omega$ (6 places) |
| | p. 290:Fig. 4.3-5 Caption | (6) should be (16); (7) should be (17) |
| | p. 291:Exer. 4.3-1 (last line) | ... $-[\alpha_{n-1} \ldots \alpha_1]'$ |
| | p. 300:lines 7,8 | 2n-th degree characteristic polynomial, say $p(s) = s^{2n} + \ldots$ |
| | p. 302:line 11 | ... + $p_{n-1}$ and ... |
| | Eq. (15) | ... + $\delta_{n-1}$ |
| | p. 303:line 6 | $\delta_n$ should be $\delta_{n-1}$. |
| | p. 310:Exer. 4.5-2 | ... choosing $p_3 = 0.1$ and ... |
| | p. 324:Eq. (30) | replace $h_{n+1}$ by $h_n$ (in 2 places) |
| Chapter 5 | p. 342:line -18 | ... $-\alpha p = (-\alpha)\cdot p$, ... |
| Chapter 6 | p. 352: Exer. 6.1-2 | ... Exercises A.1 and A.41 |
| | p. 371:Exer. 6.2-5 | Part a. is perhaps best postponed to Sec. 6.3. |
| | p. 399:line -1 | Algebra, pp. 153-158, 1977)... |
| | p. 402:line 3 | ... of the $S_k$ to ... |
| Chapter 9 | p. 608:Exer. 9.1-9 | ..., $\xi(t) = P(t)x(t)$. |
| | p. 609:below the matrix $\Phi$ | Change to: Assume that $\Phi_{22}(t,t_0)$ is nonsingular. Also change parts b,c to parts a,b. |

| | | |
|---|---|---|
| Chapter 9 | p. 621:Exer. 9.2-15. | Replace $\mathcal{C}$ by $\mathcal{R}$, where $\mathcal{R}(t_0,t) = \int_{t_0}^{t} \Phi(t,\tau)B(\tau)B'(\tau)\Phi'(t,\tau)\,d\tau$ = the reachability Gramian. |
| | p. 622:line 3 | vectors $\{\mathcal{R}^{\frac{1}{2}}(t_0,t_1)p\}$, where $\mathcal{R}^{\frac{1}{2}}$ is a square-root of the reachability gramian and p ... |
| Appendix | p. 654:Exer. A.17 | We must assume that the first $\alpha$ leading minors of A are nonzero. (Otherwise we can only claim that PA = LDU, for some permutation matrix P.) |
| | p. 657:Exer. A.23.2 | ... of the powers $s^{n-i}$ in ... |
| | p. 661:line 4 | $c(sI - A_c)^{-1}b = \ldots$ |
| | line 5 | $\beta(s) = \beta_n s^{n-1} + \ldots + \beta_1$ |
| | p. 662:Exer. A.39.2 | ... set of n linearly independent eigenvectors, ... |
| | p. 663:line 1 | 4. Show ... |
| | line 3 | ... the rows as in ... . |
| | p. 664:line -3 | delete ", with $p > m$" |

UPDATING THE REFERENCES

Chapter 3: Ref. 36 appears in IEEE Trans. Automat. Contr., AC-24, pp. 913-921, Dec. 1979.

Chapter 5: Ref. 8 does not appear in the conference proceedings (so also Ref. 49, Ch. 10).

Chapter 6: Ref. 8 is to appear in SIAM J. Contr. and Optim., 1980 (so also Ref. 37a, Ch. 7).

Ref. 23 appears in Lin. Alg. and Applns., 27, pp. 103-140, Oct. 1979.

Ref. 46 should be dated Dec. 1978.

Ref. 49 should be dated 1980 (so also for Ref. 5, Ch. 10).

Ref. 51 appears in Int. J. Contr., 30, pp. 235-243, Aug. 1979 (so also Ref. 41, Ch. 7)

Chapter 9: Ref. 21 appears in IEEE Trans. Automat. Contr., AC-24, pp. 866-878, Dec. 1979.

3b.

# ERRATA FOR LINEAR SYSTEMS by T. KAILATH

## (Second and Third Printings)

page 11:

$$\dot{x}(t) + 2\,x(t) = \delta(t)\,,\ t > 0-\ \ ,\ \ x(0-) = 1$$

page 14:

$$q(t) = \int_0^t i(\tau)\,d\tau = \begin{cases} Qt/\varepsilon_0 & 0 \le t \le \varepsilon_0 \\ Q & t \ge \varepsilon_0 \\ 0 & t < 0 \end{cases}$$

page 19, **Eqn. (13)**: the right hand side should be $= u^n(\cdot - t)$

page 22, line 2: $\int_{-\infty}^{\infty} u(\tau)e^{-j2\pi f\tau}\,d\tau$

page 26, Figure for **Exercise** 1.3-1: $x(t)$ should read $y(t)$

page 48,, **Figure 2.1-13**: delete $(-)$ sign before $\frac{1}{s+\gamma}$ block.

page 61, 4th line: the last term $u$ should be $u_0$

page 65, line -9: ... by our original relation (33),

page 66, last line: $\cdots = \det\, T^{-1}(sI - A)T = \det(sI - T^{-1}AT)$

page 77, **Problem 2.2-23**: no $\cdot$ at crossover point of wires

page 83, lines 11 and 12: (2.2-5) and (2.2-9) should be interchanged

page 91 **Eq. (14)**: $Y(z) = c(zI - A)^{-1}b\ U(z) +$

page 92, line above **Eq. (20)**: [cf. 2.2-48)]

page 97, line -1: Fig. 2.3-1 not 2.3-2.

page 101, **Eq. (34)**: $a_n$ should be $a_{n-1}$

page 111, **Exercise 2.3-3.**: *change 'representation' to 'realization'.*

*page 111*, **Exercise 2.3-3-b**: ... which this realization loses either controllability or observability or both?

page 117, **2.3-28**: $\Phi(k,j) = A(k-1) \ldots\ldots A(j)$, (no commas)

page 118, **2.3-31**, line -10: $g_0 + \cdots g_1 z + \ldots\ldots + g_m z^{m-1}$

page 124, **Lemma 2.4.1**: connected by a unique similarity ....

page 124, line -4: Example 2.3-4 is already ...

page 139, line -9: standard form of Sec. 2.4.2.

**page 139 and elsewhere**: the statements that modes and natural frequencies are observable, nonobservable, etc., are ambiguous unless the realization has distinct eigenvalues.

page 159, **Exercise 2.4-16**: delete all words from $\bar{A}_{1,3}$ onwards. Replace by "variables $\bar{x}_{\bar{c}}$ in Eq. (2.4-11) are always noncontrollable. Give the dual argument for the states $\bar{x}_0$ in Eq. (2..4-16)"

page 163: An upper dot is missing from $E(t)$ in the equation above (17):

$$\frac{d}{dt}[e^{-At}E(t)] = -Ae^{-At}E(t) + e^{-At}\dot{E}(t)$$

page 170: $\vec{q}_1$ should be $\vec{q}_2$ and vice versa in Figure 2.5-1

page 171, line 7: Let $\vec{q}_1$ be ....

page 171, lines 13, 14: no arrows over $p_1$ and $p_2$

page 171, lines -5 and -6: delete the sentence 'Although .... some'.

page 176, line 1: delete '(only if)'

page 176, line 5: delete '(the "if" part)'

page 181, **Exercise 2.6-1**: If a constant symmetric matrix $P$ ...

page 196, **Exercise 3.1-4.**: in the second line, $G_c(s)$ should be $G_f(s)$

page 197, **Figure 3.2-1**: Add $u(t)$ to the Figure before the block marked $b$

page 209, **Exercise 3.2-4**, part b): $v(s)$ and $u(s)$ should be interchanged:
$u(s) = v(s) - g(s)\xi(s)$

page 211, line 6: $\pm\sqrt{g/L + 1}$ should be $\pm\sqrt{g/L + k}$

page 211, line 10: $k_1 = g/L - 1$ should be $k_1 = -(g/L) - 1$

page 212, line -2: $n^2 \rightarrow \omega^2$

page 213, **Exercise 3.3-3**, line 8:

$T = 2\pi/\sqrt{a/g}$ should be $T = 2\pi\sqrt{a/g}$

page 214, **Exercise 3.3-4**, in solution:

$$H_k(0) = -\frac{1}{24}w^2 \text{ should be } H_k(0) = -\frac{1}{24\omega^2}$$

page 217, **3.3-5**, line -5: $\delta$ should be $u$

page 223, line 22:

$$J(k) = \begin{cases} \dfrac{-(1+rk^2)(a-k)^{-1}}{2} x_0 , & -a-k<0 \\ \infty , & a-k>0 \end{cases}$$

page 225, last line: Example 3.3-3.

page 230, Eq. (30): the + should be −

page 233, **Exercise 3.4-1**, last line: delete 'poles with'

page 261, **Eqs. (3), (4)**: $x_0 - \varepsilon \cdots$

page 264, **Eqs. (11), (12)**: $\mathbf{O}'(c,A)$ and $\mathbf{O}^{-1}(c,A)$.

page 265, **Example 4.1-1**, Solution:

$$\dot{z} = \begin{bmatrix} 0 & 1 \\ 9 & 0 \end{bmatrix} z + \begin{bmatrix} 0 \\ -1 \end{bmatrix} u$$

page 266, **Example 4.1-2**: The numerical values are in error: replace

4999.99 by 4900

2499.98 by 1200

2500 by 1250

page 267, line 12: (according to Example 2.4-4)

page 270, line 19: change A20 to A21

page 274, line -5: and e

page 278, **Fig. c**, top line: $u = -\hat{w}$

page 282, line 2 in footnote: conventional

page 307, **Eq. (26c)**: + not −.

page 332, line 8: $\bar{x}_i$ should not be boldface

page 347, line -6: $d(s) = \cdots - 12s + 9$

page 355, line 5: 'block observer form' not 'block observer canonical form'

page 357, line -12: $nm$ columns of $C$

page 362, line 3: should say $C(A,B) = TC(\bar{A},\bar{B})$ not $C(A,B) = C(\bar{A},\bar{B})T^{-1}$

page 362, line 9: should say $\dot{\bar{x}}_c(t) = \bar{A}_c\bar{x}_c(t) + \bar{A}_{12}\bar{x}_{\bar{c}}(t) + \bar{B}_c u(t)$

page 401, **Exercise 6.3-18**, line 2: polynomial vector in the range of $F(s)$.

page 407, **Example 6.4-1**: in $S(s)$, $s^3$ should be $s^2$ and vice versa.

page 506, **Exercise 7.1-1: The** (1,2) element of $R$ should be $-K$, and the (2,2) element should be $G^{-1}$.

page 556, line -2: the second $P(s)$ should not be boldface.

page 601, Eq. (20a): $\int_{t_0}^{t}$

page 602, line -3: using (25) and (29)

page 602, **Fig. 9.1-1**: $\Phi(\cdot,t_0)B(\cdot) \to \Phi(t_0,\cdot)B(\cdot)$ ; $\varepsilon(\cdot) \to \xi(\cdot)$

page 603, **Exercise 9.1-1**, part 2: $Q$ not $Q'$

page 604, line -3: $N(\tau)$ not $N(t)$

page 621, **Exercise 9.2-13**, line 4: 2..6-1 not 2.5-1.

page 638, line 3: ... Goodman [21], is ...

page 641, line 3: M. P. Ekstrom ...

page 643, **Ref. 45**: M. Fliess, "Un codage noncommutatif pour certain systémes échantillonn ès non linéaires", *Inform. Contr.*, vol 38, pp. 264-287, September 1978.

page 656, line 13: Math. Comp. **29** not **27**

page 661, line 1: $a_{n-1}$ not $a_n$

Index, page 672: Friedlander: drop 226, 253, 296.

Index, page 674; Verghese: drop 226, 247, 253, 296, 619.

Index, page 675: Adjugate matrix, 649, 662.

Index, page 676: add Detectability ... 230

Index, page 676: add Duality, 44, 50, 51, ...

Index, page 677: add Fibonacci sequence, 116