

Errors (second printing, to be fixed in third printing)  
**Iterative Methods for Linear and Nonlinear Equations**  
 C. T. Kelley, September 18, 2010

The 3rd printing should take place in early 1998. Please send me more errors!

- page *xii* line -10, change “Moody Chu, Andreas Griewank” to  
 “Moody Chu, Howard Elman, Jim Epperson, Andreas Griewank”  
 line -9, Change “Vickie Kearn” to “Lea Jenkins, Vickie Kearn, Belinda King”  
 line -8, Change “Jeff Scroggs” to “Jeff Scroggs, Joseph Skudlarek”  
 line -8, Change “Mike Tocci” to “Mike Tocci, Gordon Wade”  
 line -4, Change “hundred” to “hundred and ten”  
 line -1, Change 1995 to 1998
- page 3 line 15, change “ $R^N$  The” to “ $R^N$ . The”
- page 6 line 17, change “inverse of  $A$ . Then” to “inverse of  $A$ , then”
- page 12 line -3, change  $\|b - Ax\|_{A^{-1}}$  to  $\|b - Ax\|_{A^{-1}}^2$
- page 23 Delete the words “In theory, one might avoid this problem”
- page 25 line 8, replace  $(b - Ax)^T(b - Ax)^T$  by  $(b - Ax)^T(b - Ax)$
- page 26 line 9, change “proved a code” to “provide a code”  
 line -5 should be
- $$\alpha_{ij} = -a(x_i, x_j)h^{-2}/2.$$
- page 27 line 18, change  $\|u^* - u_k\|_A/\|b\|_A$  to  $\|u^* - u_k\|_A/\|u^* - u_0\|_A$
- page 37 line 16, change “each iteration” to “at each iteration”
- page 38 line 8, change “ $i \times i$ ” to “ $i \times i$  matrix”  
 line 13, change  $R^{k+1}$  to  $R^{i+1}$   
 line 19, change  $h_{ji} = (Av_i)^T v_j$  to  $h_{ij} = (Av_j)^T v_i$   
 line 21, change  $i > j - 1$  to  $i > j + 1$   
 line 22, change “orthogonal matrices” to “matrices  $\{V_k\}$  with orthonormal columns”
- page 39 line 21, change  $k = k + m$  to  $k = m$  line -3, change “accumulated roundoff” to “cancellation”
- page 41 line 12, change “loose” to “lose”  
 line -4, change  $h_{jk} = h_{jk} - h_{tmp}v_j$  to  $h_{jk} = h_{jk} + h_{tmp}$
- page 44 The first sentence of paragraph 3 should read  
 “Let  $H$  be an  $N \times M$  ( $N \geq M$ ) upper Hessenberg matrix with rank  $M$ .”  
 In equation 3.15  $s_1 = -h_{32}/\sqrt{h_{22}^2 + h_{32}^2}$  should be  $s_2 = -h_{32}/\sqrt{h_{22}^2 + h_{32}^2}$   
 In the line below equation 3.15 “and annihilate  $h_{22}$ .” should be “and annihilate  $h_{32}$ .”
- page 45 line 3, change  $H_k = Q_k R_k$  to  $R_k = Q_k H_k$   
 line 4, change “ $H_k$  we” to “ $H_k$ , we”  
 line 5, change  $Q_{k+1}$  to  $Q_k$   
 line 6, change “ $(k + 1)$ st” to “ $(k+2)$ nd”
- page 47 line 10, change “get its name” to “gets its name”
- page 50 line 10, change “has” to “has a”  
 step 2(g) of Algorithm `bicgstab` should be  
 (g)  $\omega = t^T s / \|t\|_2^2$ ,  $\rho_{k+1} = -\omega \hat{r}_0^T t$   
 line -6, change “the many” to “many”
- page 51 line 6, change “nonsingular” to “full-rank”
- page 55 line -11, change “transpose” to “transpose (adjoint)”
- page 66 line -7, change “map may” to “map, may” (ie add a comma)
- page 69 line -13, change “ $\|e\|$ ” to “ $\|e\|$ .”  
 line -12, change “reducing  $\delta$  if needed so that  $\gamma\delta < \|F'(x^*)\|$  implies (4.5)” to “Hence (4.5) holds if  $\gamma\delta < \|F'(x^*)\|$ .”
- page 70 line -4 change  $\|I - F'(x^*)^{-1}F'(x^* + te)\|$  to  $\| \int_0^1 I - F'(x^*)^{-1}F'(x^* + te) dt \|$
- page 73 line -16, change “all” to “most of”  
 line -7, change “dense, however” to “dense. However”

- page 76 line -5, change “ $e_n, e_0 \in \mathcal{B}(\delta)$ ” to “ $x_n \in \mathcal{B}(\delta)$ ”
- page 77 line 5, change “Iterations” to “Methods”  
line 19, change “solve” to “solution”
- page 79 line 15, change  $y_0 = x_n$  to  $y_1 = x_n$   
line -2, change  $\epsilon(x + h)$  to  $\epsilon(x + hw)$
- page 80 line 2, change  $\epsilon(x + h)$  to  $\epsilon(x + hw)$   
line 17, change “(at  $x + h$ )” to “(at the point  $x + hw$ )” first line of paragraph before Def 5.4.1, change “to the derivative” to “to the directional derivative”
- page 81 lines 8, 15, Change  $\epsilon(x)$  to  $\|\epsilon(x)\|$   
lines 10, 12, Change  $\epsilon(x)$  to  $\bar{\epsilon}$   
lines 17, 21, Change  $\epsilon(x_c)$  to  $\bar{\epsilon}$  (but **no change** on line 19)  
lines 25, 26, 28, Change  $\epsilon(x^*)$  to  $\bar{\epsilon}$ .
- page 83 line -12, replace “ $\beta, \eta,$  and  $\gamma$ ” with “ $\beta, \eta, \bar{r},$  and  $\gamma$ ”
- page 87 line -10, replace “continuous” with “the continuous”  
lines -4 and -1, change “ $\|F(x_n)\|/\|F(x_0)\|$ ” to “ $\|F(x_n)\|_\infty/\|F(x_0)\|_\infty$ ”
- page 88 first line after the table, change “ $\|F(x_n)\|/\|F(x_0)\|$ ” to “ $\|F(x_n)\|_\infty/\|F(x_0)\|_\infty$ ”
- page 91 first line in exercise 5.7.4, change “ $x_h$ ” to “ $x_n$ ”
- page 94 first line in exercise 5.7.26, change “eigenvalue/eigenvector” to “eigenvector-eigenvalue”
- page 96 in equation (6.3) change  $+F'(x_c)^{-1}r$  to  $-F'(x_c)^{-1}r$
- page 97 line -1, period missing from end.
- page 98 line 3, delete “using (6.5)”  
line 10, change “(4.7), (6.5), and (6.2)” to “(4.7) and (6.5)”
- page 99 line 2, change “to with” to “with”  
line 20, change  $|F'(x^*)|^{-1}\kappa(F'(x^*))^{-1}\delta_0$  to  $\|F'(x^*)\|\delta_0$   
line -7, change “results.” to “results in”
- page 101 line 12, change “Newton-GMRES” to “GMRES”  
line 14, change “first” to “last”
- page 102 line 3, change “bases.” to “bases:”  
line 12, change “ $\bar{h}$  and  $\delta$ ” to “ $C_G, \bar{h},$  and  $\delta$ ”  
line 15, in equation (6.13) change  $4\gamma$  to  $C_G$   
line 22, change  $F(x, u_j)$  to  $F(x : u_j)$   
change  $thu_j$  to  $th\|x\|_2u_j$   
line 23, change  $thu_j$  to  $th\|x\|_2u_j$   
line 25, change “have” to “have, with  $\bar{\gamma} = \gamma(\|x^*\|_2 + \delta)$ ,”  
line 26, change  $(B - F'(x))u$  to  $B - F'(x)$   
change  $h\gamma/2$  to  $h\|x\|_2\gamma/2 \leq h\bar{\gamma}/2$   
line -10, change “we have,” to “we have, since since  $B$  and  $G_h F$  agree on  $\mathcal{K}_k$ ,”  
line -7, in equation (6.15) change  $< \eta$  to  $\leq \eta$   
change  $\gamma$  to  $\bar{\gamma}$   
line -5, change  $\bar{h}\gamma \leq 1$  to  $\bar{h}\bar{\gamma} \leq \|F'(x^*)^{-1}\|_2^{-1}/2$   
line -2, change  $(1 + \eta)\|F(x)\|_2/(1 - \bar{h}\gamma/2)$  to  $(1 + \eta)\|F(x)\|_2 + \bar{h}\bar{\gamma}\|s\|_2/2$ .  
line -1, delete this line
- page 103 line 1, change 8 to  $4(1 + \eta)\|F'(x^*)^{-1}\|_2$   
line 2, change “the proof.” to “the proof with  $C_G = 4\bar{\gamma}(1 + \eta)\|F'(x^*)^{-1}\|_2$ .”  
line 13, change “standard assumptions” to “assumptions of Proposition 6.2.1”  
change “Then there” to “Then there are”  
line 15, change  $4\gamma$  to  $C_G$   
line 18, change “fgrmes” to “fdgmres” line -8, change “standard assumptions” to “assumptions of Proposition 6.2.1”  
line -6, change  $4\gamma$  to  $C_G$  line -3, change “fgrmes” to “fdgmres”
- page 104 line 9, change “as solver” to “as the solver”
- page 105 line -12, change “that is really” to “than is really”
- page 113 line 9, change “coefficient” to “the coefficient”

- page 115 lines 1 and 2, change “section” to “section,” and “problems” to “problems,”
- page 117 line -2, delete “and (7.17)”
- page 118 change  $(Ax_c - Ax_+) - B_c(x_c - x_+)$  to  $(Ax_+ - Ax_c) - B_c(x_+ - x_c)$
- page 119 line 8, change  $\|I - \theta_c P_s\|_2 = 1$  to  $\|I - \theta_c P_s\|_2 \leq 1$
- page 120 line 12, change  $\phi^T(E_n^T v)$  to  $\phi^T(E_n v)$
- page 122 line 16, change “The then q-factor” to  
“Then, reducing  $\delta$  and  $\delta_1$  further if needed, the q-factor”  
line 20, change “To this” to “To do this”  
line 24, change  $\|E_n\|_2 < \delta_1$  to  $\|E_n\|_2 \leq \delta_1$   
line 26, change “deterioration Theorem 5.4.3” to “Theorem 7.2.2,”
- page 124 line 9, replace  $\xi_n$  by  $y_n$   
line 18, replace  $F(x_{n+1})$  with  $F(x_{n+1})s_n^T$   
line 19, replace  $F(y_{n+1})$  with  $F(y_{n+1})s_n^T$   
line -6, change “case” to “case,”  
line -5, put a period at the end of equation (7.37)
- page 125 line 2, replace  $\|s_n\|$  with  $\|s_n\|_2$  twice  
line -13, put a colon at the end of the line  
line -10, put a period at the end of the line
- page 126 line 1, change “directly because” to “because”  
lines 3–4, In Equation (7.43) change  $I-$  to  $I+$  three times  
line 16, change “imput” to “input”  
line -1, step *e-ii* in `brsol`: change  $z = z + s_j s_{j-1}^T z / \|s_{j-1}\|_2^2$  to  
 $z = z + s_{j+1} s_j^T z / \|s_j\|_2^2$
- page 127 line 1, step *e-iii* in `brsol`: change  $s_n = z / (1 + s_{n-1}^T z / \|s_{n-1}\|_2^2)$  to  
 $s_{n+1} = z / (1 - s_n^T z / \|s_n\|_2^2)$   
line 11, change “interests” to “interest”
- page 128 line 7, change “as iterations progress.” to “as iterations progress,”
- page 132 line -3, change “root” to “root so that”
- page 137 line -7, change  $x_t = x + \lambda s$  to  $x_t = x + \lambda d$
- page 138 line -5, change  $(x, f, \tau)$  to  $(x, f, \tau, \eta)$ .
- page 139 line 12, change “**nsola1**” to “**nsola**”  
line -8, change “linesearch” to “line search”  
line -7, change “**nsola1**” to “**nsola**”
- page 140 line -4, change “is” to “will be”
- page 141 line 14, change  $x^*$  to  $x^*$
- page 142 line -4, change “an 2nd degree” to “a 2nd degree”
- page 143 line 12, change “Since our approximation of  $f'(0) < 0$  and  $f(\lambda_c) > f(0)$ ” to  
“Our approximation of  $f'(0) < 0$ , so if  $f(\lambda_c) > f(0)$ , then”  
line -8, change  $\frac{\lambda}{\lambda - \lambda_-}$  to  $\frac{\lambda}{\lambda_c - \lambda_-}$   
line -7, delete “the curvature of  $p$ ”  
line -6, change  $\frac{2\lambda_c \lambda_-}{\lambda_c - \lambda_-}$  to  $\frac{2}{\lambda_c \lambda_- (\lambda_c - \lambda_-)}$
- page 144 line 18, change “ $u_n = \frac{y_n - B_n s_n}{\|s_n\|_2}$  and” to “ $u_n = \frac{y_n - B_n s_n}{\|s_n\|_2}$ ,  $v_n = \frac{s_n}{\|s_n\|_2}$ , and”  
line 19, change “use (8.7)” to “use (8.7) and (7.38)”  
line -3, change  $d_{n+1} =$  to  $d_{n+1} = -$   
line -1, change equation (8.9) from

$$d_{n+1} = - \frac{B_n^{-1} F(x_{n+1}) - (1 - \lambda_n) s_n}{1 + \lambda_n s_n^T B_n^{-1} F(x_{n+1}) / \|s_n\|_2^2}$$

to

$$d_{n+1} = - \frac{\|s_n\|_2^2 B_n^{-1} F(x_{n+1}) - (1 - \lambda_n) s_n^T B_n^{-1} F(x_{n+1}) s_n}{\|s_n\|_2^2 + \lambda_n s_n^T B_n^{-1} F(x_{n+1})}$$

- page 145 line 1, change “We the” to “We then”  
line 13 and line -9, change “linesearch” to “line search”  
line 15, delete “If (8.2)”  
line -12, in step 2(e)ii of brsola change  $a = -\lambda_{j-1}/\lambda_j$ ,  $b = 1 - \lambda_{j-1}$  to  
 $a = -\lambda_j/\lambda_{j+1}$ ,  $b = 1 - \lambda_j$   
line -11, in step 2(e)ii of brsola change  $z = z + (as_j + bs_{j-1})s_{j-1}^T z / \|s_{j-1}\|_2^2$  to  
 $z = z + (as_{j+1} + bs_j)s_j^T z / \|s_j\|_2^2$   
line -10, in step 2(f) of brsola change  $d = (z + (1 - \lambda_n)s_n) / (1 + \lambda_n s_n^T z / \|s_n\|_2^2)$  to  
 $d = (\|s_n\|_2^2 z + (1 - \lambda_n)s_n^T z s_n) / (\|s_n\|_2^2 - \lambda_n s_n^T z)$
- line -8, in step 2(h) of brsola replace  $\lambda d$  with  $\lambda_{n+1}d$
- page 146 line 5, replace “§§ 6.4” with “§ 6.4”  
page 147 line -8, change “case” to “case reduced”  
page 149 line 12–13, change “two methods” to “the two methods”  
page 151 line -9, change “well” to “well.”  
line -7, in problem 8.5.9 “5 to” should be “5, to”.  
line -6, change “do to” to “to do”
- page 152 line 2, change “linesearch” to “line search”  
page 162 In reference 194 “Dissusion” should be “Diffusion”