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Errata for *Iterative Methods for Sparse Linear Systems*

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23	Next, it is proved by contradiction that there are no $\underline{\text{nonlinear}}$ elementary divisors.
30	Since $\underline{\operatorname{diag}(D)} > 0$ . . . (assuming that $A > 0 \iff \forall i, j\ (a_{ij} > 0)$)
31	Since $a_{ik}c_{ki} \leq 0$ for all $\underline{k \neq i}$ . . .
32	The matrix D_B is positive because $\underline{\operatorname{diag}(D_B)} \geq \underline{\operatorname{diag}(D_A)} > 0$ (again assuming that $A > 0 \iff \forall i, j\ (a_{ij} > 0)$).
119	The definitions here should use row sums (i.e., $\sum_{j=1,\, j\neq i}^{j=n} \cdots$) for consistency with the proof of Theorem 4.9 on p. 122.
120	There is an extraneous negative sign on the right-hand side of the first equation in the proof of Theorem 4.6.
121	. . . cannot be an interior point to the disc $D(\underline{a_{mm}}, \rho_m)$.
121	. . . it is necessary that $\lvert\xi_j\rvert = 1$ for $\underline{\text{all } j \text{ such that } a_{mj} \neq 0}$. (This does not change the rest of the proof.)
122	$$\sum_{\underline{j>m}} \underline{-a_{mj}} \xi_j = \lambda\Big(a_{mm}\xi_m + \sum_{\underline{j<m}} a_{mj}\xi_j\Big),$$ which yields the inequality $$\lvert\lambda\rvert \leq \frac{\sum_{\underline{j>m}} \lvert a_{mj}\rvert \lvert\xi_j\rvert}{\lvert a_{mm}\rvert - \sum_{\underline{j<m}} \lvert a_{mj}\rvert \lvert\xi_j\rvert} \leq \frac{\sum_{\underline{j>m}} \lvert a_{mj}\rvert}{\lvert a_{mm}\rvert - \sum_{\underline{j<m}} \lvert a_{mj}\rvert}.$$
145	. . . its symmetric part $\underline{(A + A^T)/2}$ is Symmetric Positive Definite . . . (for consistency with (1.50) and p. 215)
163	Thus, the $n \times \underline{(m+1)}$ matrix $[h_0, h_1, \ldots, h_m]$ . . .
178	Replace $h_{66}^{(5)}$ with $\underline{h_{66}}$ in (6.45).
181	Since γ_m is defined as the last component of g_m after Ω_m is applied, while $\gamma_m^{(m-1)}$ is defined as the last component of $\overline{g}_{m-1}$ (i.e., $\gamma_m = c_m\gamma_m^{(m-1)}$), the last component of $\overline{g}_5$ in (6.49) should be $\underline{\gamma_6^{(5)}}$. However, this creates a conflict with the definition of $\overline{g}_m$ in (6.40).
185	$W_{m+1} = V_{m+1}S$ $\underline{\text{has orthonormal columns}}$.
185	Change r^G to $\underline{r_m^G}$ in (6.61).
185	*The assertion* $\kappa_2(V_{m+1}) = \kappa_2(S)$ *does not seem evident.*
185	*The condition number of a rectangular matrix has not been defined at this point.*
196	. . . the method is a realization of an orthogonal projection technique onto the Krylov subspace $\underline{\mathcal{K}_m(A, r_0)}$ . . .
200	The vectors p_j are multiples of the $\underline{p_{j+1}}$'s of Algorithm 6.17.

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206	... if $h_{ij} = 0$ for $i < j - s + 1$, then an $\underline{(s+1)}$-term recurrence can be defined ...
207	... since A has μ distinct eigenvalues, there is a polynomial q of degree <u>at most</u> $\mu - 1$ such that $q(\lambda_i) = \overline{\lambda_i}$ ...
207	We do not necessarily have $\mu - 1 \leq s - 1$; what is in fact needed for this proof is $\nu(A) \leq \deg(q) - 1$ and $\deg(q) - 1 \leq s - 1$. The former is a consequence of the fact that $A^H = q(A)$, and the latter is demonstrated by the rest of the proof.
207	*The fact that there exists a nonzero vector of grade μ does not seem trivial.*
208	$(Av_j, v_i) = 0$ for all i, j such that $i + s \leq j \leq \mu(v_1) - \underline{2}$
208	*The definition of CG(s) given is in fact CG(s+1) according to the original definition of Faber and Manteuffel; with this definition the following adjustment is necessary:*
208	... if and only if the minimal polynomial of A has degree $\leq \underline{s+1}$, or ...
208	... it is easy to show that in this case A either has a minimal degree $\underline{=} 1$, or ... (see Faber and Manteuffel for an explanation)
210	... has two solutions w which are inverse<u>s</u> of each other.
211	*I was unable to locate Zarantonello's lemma in the given reference; nevertheless, I have written a simple proof of it here:* `http://www.cs.ubc.ca/~njhu/math/zarantonello.pdf`
211	... the ellipse $E(0, 1, \underline{(\rho + \rho^{-1})/2})$ reduces to ... (for consistency with p. 213)
211	$\underline{\lvert\gamma - c\rvert} > \rho$
213	Plugging in $z = c + a$ does not give $C_k(a/d)$ in the numerator but rather $C_k(-a/d)$. This can be rectified by writing $\hat{C}_k(z) = C_k((z-c)/d)/C_k((\gamma - c)/d)$, which is equivalent by symmetry of the Chebyshev polynomials.
223	In P-6.1(d), the dimensions of the matrices being multiplied are incompatible.
233	... there is a scalar γ_j such that $\hat{w}_{j+1} = \gamma_j p_j(A^T)\underline{w_1}$.
233	$\langle p_j, p_j \rangle = \underline{(p_j(A)v_1, p_j(A^T)w_1)}$ (by (7.7); no γ_j factor)
252	Multiplying (7.62) by A results in $Ap_{2j} = Au_{2j} + \beta_{2j-2}(Aq_{2j-2} + \underline{\beta_{2j-2}} Ap_{2j-2})$ ...