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ERRATA FOR:  
A Finite Element Primer for  
Beginners

The Basics

## Errata:

1. P. 5, at the bottom, there is a missing parenthesis “(“; should read:  
(temperature in heat conduction applications, concentration in diffusion applications, etc (see Appendix B))
2. P. 8, instead of positive inside should be with the same sign as  $r$  inside.
3. P. 10, eq. (2,18), the  $\approx 0$  at the end should be omitted.
4. P. 10, eq. (2.19), the last  $+$  sign should be  $-$ .
5. P. 13, the weak form at the bottom: essential BCs for  $u$  are missing:  
 $u|_{\Gamma_u} = d$ .
6. P. 14, eq. (3.3),  $u(x)$  should be  $u^h(x)$ .
7. P. 14, eq. (3,3),  $v(x)$  should be  $v^h(x)$ .
8. P. 15, it is not enough to require that  $\phi_i(x_j) = \delta_{ij}$ ; one should also require that  $\phi_i$  is zero outside the elements that share DOF  $i$ . Thus,  $\phi_i(x) = 0$  outside of the elements that share node  $i$ .
9. P. 17, In Equation 3.11 an  $J(\zeta_i)$  is missing.
10. P. 17, In Equation 3.11  $N$  should be a  $G$  as well as everywhere else on page 17.
11. P. 18,  $N$ 's should be  $G$ 's.
12. P. 20, the relation  $R_i = \sum_e R_i^e$  is missing after Equation 3.26.
13. P. 20, In the text  $M(\zeta)$  is used but in (3.27)  $M_x(\zeta)$  is used.
14. P. 21, In equation (3.34) the “4” before the equal sign should be eliminated.
15. P. 21, the under-equation braces in (3.33) and (3.34) should not include the sum signs.
16. P. 22, the term virtual energy is used here as if it is familiar to the reader, but was not mentioned before. The phrase “weak form” should be used.
17. P. 25, eq. (3.47), what is  $a_1$ ? At the top of p. 23  $u(0) = 0$  is given. Thus,  $a_1 = 0$  in this case.
18. P. 25, saving in storage is mentioned owing to the locality of the FE functions and the sparseness of the global matrix, but the even more important saving in computing time is not mentioned. Thus, should be emphasized here (it is discussed later).
19. P.26, a minus sign is missing for  $\hat{\phi}(\zeta) = -\frac{1}{2}(1 - \zeta)\zeta$ .
20. P. 29, 1D is missing from the chapter title.
21. P. 30, it should be stated that  $z^h$  is any kinematically admissible function.
22. P. 32, eq. (4.16), the space to which  $w$  belongs is missing (it is a kinematically admissible function)
23. P. 33, eq. (4.20), the  $=0$  at the end is not clear, and should be omitted.
24. P. 33, The phrase: “This is sometimes refereered to as the Euler-Lagrange equation of the potential.” should be omitted.
25. P. 35, first equation (the Eqn number is missing), the under-equation braces are not consistent: the first brace (interior residual) leaves the

weighting function  $v$  out, while the second brace (interface residual) includes it.

26. P. 35, the derivation of eq. (4.28) can be found in Ainsworth and Oden. The  $r_\Omega$  should be just  $r$  and the  $r_{\partial\Omega}$  should be just  $r$ . The period “.” should be outside the equation.
27. P. 37, Equation 5.2 a paranthesis “(“ is missing before the N-3.
28. P. 37, the term element-by-element appears in the title and should be eliminated.
29. P. 40, in the equation after (5.10), starting with  $\lambda^I$ , there is inconsistency with  $i$  and  $i+1$  appearing there. It should read
 
$$\lambda^i \|\{r\}^i\|_K^2 = \|\{a\}^{i+1} - \{a\}^i\|_K^2 \stackrel{\text{def}}{=} (\{a\}^{T,i+1} - \{a\}^{T,i})[K](\{a\}^{i+1} - \{a\}^i)$$
30. P. 40, before GO TO STEP 2 one should increase the value of  $i$  by 1. It should read
 

If  $\|\{a\}^{i+1} - \{a\}^i\|_K \geq \tau = \text{TOL} \Rightarrow \text{GO TO STEP 2 WITH } i = i + 1$
31. P. 40, the superscript 1/2 should be  $i/2$ .
32. P. 43, ndof is the same as  $N$  which was used before. ndof= $N$
33. P. 43, eq. (5.22), no sum should be indicated, since in other places the summation convention was used.
34. P. 47, eq. (6.8), here and in some other places, the summation convention is used. It is not mentioned/explained in the text, and in some other places it is not used. It would be helpful to use it (or not use it) more consistently, and to include some explanation on it in Appendix A.
35. P. 49, The phrase: “This is sometimes refereered to as the Euler-Lagrange equation of the potential.” should be omitted.
36. P. 49, in Equation 6.20,  $\cdot d$  should be  $\cdot \mathbf{d}$ .
37. P. 69, 3D is missing from the chapter title.
38. P. 75, why  $\Psi$  and  $\hat{v}$  are bold? In this section they are scalars.
39. P. 78, eq. (9.24), there is a time-derivative (dot) missing in two places:  $[M]\{\dot{\mathbf{a}}^{L+1}\}$  and  $[M]\{\dot{\mathbf{a}}^L\}$ .
40. P. 79, eq. (9.25), a brace is missing.
41. P. 82,  $\gamma$  is between 1 and 3 because a direct solver, employing Gaussian elimination could be no more expensive as  $\mathcal{O}(N^3)$  and the best spare iterative solver can be no smaller than  $\mathcal{O}(N)$ .
42. P. 107, 3rd line after (C.1): “If  $s^I, \dots$ ” should be stricken.