ASEN 5007 Introduction to Finite Element Methods Fall 2013

Homework Assignment # 10, covering Chapters 23–24.

Due Thursday, December 5 for on-campus students, Th Dec 12 for CAETE students

Please do not forget to attach this cover sheet to your returned homework and write your name(s) on it

Exercise 23.7 (derivation of 8-node quadrilateral shape functions and elememt programming)

Exercise 24.2 (derivation of 5-node triangle shape functions and element programming)

Grading weights: give at the start of each exercise.

For Exercise 23.7 derive the 8 shape functions first completing those given in Chapter 18. Check that their sum is exactly one before stating to program.

For Exercise 24.2 derive the 5 shape functions first. Note that midnodes 4 and 5 are on sides 1–2 and 2–3, respectively. Using the correction method, start with the 3 shape functions of the 3-node triangle $\hat{N}_i = \zeta_i$, $(i = 1, 2, 3)$; then for the corner functions apply corrections $N_i = \hat{N}_i + c_i\zeta_1\zeta_2 + d_i\zeta_2\zeta_3$ for $i = 1, 2, 3$, with c_i and d_i determined so that $N_i = 0$ at 4 and 5. The midnode shape functions are $N_4 = 4\zeta_1\zeta_2$ and $N_5 = 4\zeta_2\zeta_3$. Check that the sum of the five is exactly one (dont forget the constraint $\zeta_1 + \zeta_2 + \zeta_3 = 1$), before setting out to programming it.

To speed up programming, you may want to download the Notebooks posted in the index of Chapters 23 and 24. Some code, such as the Gauss quadrature info modules, may be reused without change. Other modules may be used as "templates" for cut-and-paste work.

Final Exam Information

The final take-home exam will be posted on the course web site on Wed December 11, 2013. It will be due 6 days later for on-campus students. CAETE students will have some extra time. Review session on Thursday December 12 (last class). Subsmission instruction details will be given on the first page of the exam document. Remote CAETE students: no EO is necessary for this exam.