ASEN 6367 — Advanced Finite Elements Methods — Fall 2018

Syllabus (Revised January 2017)

The ASEN 6367 (AFEM) course, as presently configured in its web site

http://www.colorado.edu/engineering/CAS/courses.d/AFEM.d/Home.html

embodies the following parts:

Part 0 **Introduction**. An overview provided in this Chapter.

Part 1 **Variational Methods in Mechanics**. The formulation of problems of engineering and physics in Strong, Weak and Variational Form. The material used here is part of a separate web-posted book in preparation, entitled *Advanced Variational Methods in Mechanics*, with acronym AVMM.

Part 2 **Axisymmetric Solids**. Axisymmetric solids, also called Structures of Revolution, or SOR. This formulation provides a gentle transition between the strict two-dimensional coverage of IFEM and the more realistic 3D world.

Part 3 **General Solids**. Solid elements: bricks, wedges, tetrahedra, pyramids. A first glance at techniques to improve element performance.

Part 4 **Advanced Element Derivation Tools**. The Free Formulation. The Assumed Natural Strain (ANS) formulation and its variants, primarily ANDES. The patch test. Variational crimes. Drilling freedoms.

Part 5 **Thin Plates, Membranes, Templates**. Application of the advanced element derivation techniques of the previous Part to construct plate elements as well as membrane elements with drilling degrees of freedom. Plate bending models: Kirchhoff, and Reissner-Mindlin. Elements based on conventional displacement expansions, as well as the Free Formulation (FF), Assumed Natural Strain (ANS), and Assumed Natural Deviaric Strain (ANDES), culminating with the introduction of finite element templates.

Part 6 **Shell Structures**. Facet and quadrilateral thin shell elements. Treatment of junctures. Transition elements. Thick shell elements.

The course concludes with student presentations on group term projects. Two presentations are given: progress (week after TG break) and final (last week of classes). Several Chapters posted on the web site are aimed to facilitating the group projects, including final reports from previous course offerings.