

Open Book, Open Notes, Open Web, Time Limited Test2 for Mech417

JEA08400

Available beginning April 24, 2008 and due your last final day at the ME "In-Box". **The due time for graduating students is noon Friday May 2, 2008.**

Cover Page

Instructions

You must work alone on this test. If you are not familiar with the Rice Honor system then review it before proceeding. Once you go beyond this cover page you have a maximum of two hours to work on this test, excluding an optional 30 minute break that prohibits consulting your reference materials.

Name _____ Start time _____ End time _____

1. A triangular shell element has six degrees of freedom per node (three displacements and three rotations). The mesh and local node numbers are:

Mesh: 12 22 34

Local: 1 2 3.

What are the equation numbers at a) local node 2, b) mesh node 22?

2. List four element shapes that always have a constant geometric Jacobian.
3. What are the two main functions of the Jacobian?
4. What condition must be satisfied for the shape mapping from parametric space to physical space to be reversible?
5. Assuming that the element stiffness, mass, and load arrays are known, give the matrix expressions for the element's: a) strain energy, b) kinetic energy, and c) mechanical work.
6. Briefly describe three weighted residual methods that can be employed to create a finite element integral form.
7. What are the main advantages of the method of weighted residuals over variational integral forms?
8. An element is interpolated in the parametric space $-1 \leq \xi \leq +1$. It produces a matrix integral that contains fourth degree polynomials. What are the specific locations and weights would you use as quadrature data to integrate the matrix?
9. You are solving a fourth order ordinary differential equation with a finite element approach. Which boundary terms must be treated as essential boundary conditions? Which terms will become non-essential or natural conditions?
10. Briefly describe how you change a FE matrix system of ordinary differential equations in time to a quasi-static linear system.