

4 node element distributed loading at the horizontal center line. Equivalent loading

1. Why is numerical integration used to calculate stiffness matrix? Why is the Gaussian integration more efficient than the Newton-cotes integration?
2. What are the advantages of the finite element method over the classical methods?
3. Suppose that you are developing a new finite element. How can you verify the validity of the finite element?
4. The stiffness of a structure can be obtained by assembling the element stiffnesses. Explain the background about how the structural stiffness can be obtained.
5. What is the definition of stress invariants? Why are they invariable regardless of the directions of coordinate systems?
6. In general, the majority of three dimensional material strength models are defined with the stress invariants. Explain the reason.
7. What are the conditions of shape functions when they are derived for a specific type of element?
8. Shows the nodal displacement vectors and the corresponding shape functions of 8 node plate bending rectangular elements of Mindline theory. What are the differences when they are compared to those of elements of Kirchihoff theory.
9. Only two independent material constants required to define the E matrix of isotropic materials. Explain the reason.
10. Show the strain-displacement relationships in two-dimensional polar coordinate system. What is the difference of the relationship from that of Cartesian coordinate system? What is the reason?
11. For a plane stress six node triangular element, define the shape function matrices for the nodal displacements and geometry, using the area coordinate system.

12. Let's suppose that you are going to model a plane frame structure with a wall and a moment frame. Show the finite element model of your structure. Identify the types of the elements.

13. For the following axisymmetric structure, show the structural model, the element, and the strain-generic displacement relationship. Consider efficiency in structural analysis and modeling.

14 Show the flow chart of computer program for the structural analysis using finite elements. Explain the details of the computer program. You don't have to show the program language.

15. Calculate the equivalent nodal loads for the point load in a four node plate bending element.

16. For the following four node rectangular element, calculate the equivalent nodal forces when uniform loading q is applied. Calculate the determinant of the Jacobian matrix J .