Illinois Society of Professional Engineers - University of Illinois
College of Engineering
Professional Engineer On-Line Seminars

INSTRUCTIONS:

1. View the on-line seminar.
2. Complete the quiz below.
3. Complete the "Engineer Information" section.
4. Make a copy for your records.
5. Mail the quiz along with your $20 payment (credit card information or check payable ISPE) to: ISPE, 100 East Washington Street, Springfield, IL 62701.

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Each seminar/quiz is worth 1 Professional Development Hour.

QUIZ: **05-05**
Presenter: John Hutchinson
Topic: Dynamic Buckling Under High Velocity

1. Prof. Hutchinson is well known in the fracture mechanics community for:
   a. The HRR Singularity: The asymptotic stresses and strains surrounding a mode I sharp crack in a Ramberg-Osgood material.
   b. The Williams Solution: The asymptotic stresses, strains, and displacements surrounding a sharp crack in a linear elastic material.
   c. The Griffith Criteria: The energy balance relationship between the applied external loads and the internal strain energy required to create new surfaces in a crack.

2. This seminar's topic grew out of Prof. Hutchinson's work on blast resistant sandwich plates.
   (circle) TRUE FALSE

3. Prof. Hutchinson did *not* explore which of the following structural forms to improve blast resistance?
   a. Corrugated
   b. Honeycombed
   c. Cabled
   d. Trussed

4. In a bucklewave, the plastic compression wave and the dynamic bucking are not intrinsically coupled.
   (circle) TRUE FALSE

5. Why do bucklewaves not appear in car crashes?
   a. The elements used are too thick.
   b. Car crashes occur at too low of a velocity.
   c. Stainless steel does not yield during car crashes.

6. Columns with initial imperfections, as described by Prof. Hutchinson, dissipate more energy under dynamic conditions than under quasi-static conditions because under dynamic loading the column slightly buckles.
   (circle) TRUE FALSE

7. In 1966, Abrahamson and Goodier shot what into an anvil to examine buckling effects?
   a. Ball bearings
   b. Aluminum rods
   c. Copper tubes

8. Carrier's guitar string problem cannot be directly applied to the bucklewave problem because:
   a. The boundary condition of the rod's right end is fixed and constant.
   b. The velocity of the plastic wave in the rod is greater than 1 m/s.
   c. The elastic wave velocity is several orders larger than the bucklewave velocity.
   d. The governing differential equation of the bucklewave is a fourth order ordinary differential equation.

9. The critical wave length of the initial imperfection in a bucklewave analysis is equal to the buckling length of a column with the same stress and tangent modulus under quasi-static conditions.
   (circle) TRUE FALSE

10. Lateral inertia stabilizes a column under dynamic conditions, such that, the compressed region is still only slightly buckled even though it is three times the length of a column that would buckle under quasi-static conditions.
    (circle) TRUE FALSE

11. Elastic unloading is allowed in the mathematical bucklewave problem.
    (circle) TRUE FALSE

12. Which of the following was *not* one of Prof. Hutchinson's conclusions:
    a. Buckling develops as the plastic compression wave propagates down the column.
    b. Lateral inertia stabilizes the column.
    c. The bucklewave mathematical model is inherently, fatally flawed.
    d. More energy is absorbed when dynamic stabilization is present relative to quasi-static conditions
    e. Strains as large as 20% can be attained when columns are loaded around 100 m/s.

13. When proportioning mass in a plate-column-plate system for simulation, what are realistic proportions for mass of the individual elements to the total mass?
    a. 2/5 – 1/5 – 2/5
    b. 1/3 – 1/6 – 1/2
    c. 1/3 – 1/3 – 1/3

14. When blast design is considered, momentum absorption is more important than energy absorption.
    (circle) TRUE FALSE

15. The bucklewave mathematics break down when the plastic wave speed is greater than the speed of the end being displaced.
    (circle) TRUE FALSE

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