



**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.

If you score an 80% or better on the quiz, you will receive your certificate within 4 weeks. If you fail to earn an 80% score, the quiz will be returned to you and you will have the opportunity to retake it.

Each seminar/quiz is worth 1 Professional Development Hour.

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**QUIZ:** 04-16  
**TOPIC:** Bridging Scale Mechanics and Materials  
**PRESENTER:** Prof. Wing Kam Liu, Northwestern University

1. True/False. Liu's research was conducted at the University of Texas at Austin.  
(circle) TRUE FALSE
2. What was the opening illustration for the importance of nanoscale material design?
  - a. a tooth-pick building
  - b. compression tests of small concrete cubes
  - c. an ice-cube with newspaper inside
  - d. the sudden collapse of a water tower due to freeze-thaw cycles
3. True/False. The following are the six stages in the ductile fracture mechanism in steel  
-primary inclusion  
-debonding and void nucleation  
-void growth  
-strain localization between voids  
-necking between voids  
-void coalescence and fracture  
(circle) TRUE FALSE
4. What does Liu hope to contribute to the next generation of CAE software?
  - a. the hybrid boundary element method applied to problems of potential in functionally graded materials
  - b. integration of nano- and micro-structures characteristics into the CAE capabilities
  - c. direct numerical integration of inhomogeneous material characteristics
  - d. ability to accurately predict crack propagation using meshless solution techniques
5. What does MD stand for and where is it used?
  - a. molecular dynamics, near crack/shear band tips
  - b. magnetorheological dampers, used for dissipation of earthquake forces
  - c. mass determinates, used to scale small prototypes into testable models
  - d. maximum displacement, important characteristic used in design

## QUIZ 04-16 CONTINUED

6. What concern did NSF raise concerning the research proposal of MD and its interface with micro-mechanics?
- advances in other areas will potentially surpass the capabilities of MD technology
  - MD technology is not guaranteed to give an accurate solution yet costs a tremendous amount of money
  - the inherent controversy concerning MD technology
  - most engineering students would not have the background to implement calculations for even simple molecular systems
7. True/False. Liu's research proposes the use of FEM for the general structure and MD around potential crack locations.  
(circle)            TRUE            FALSE
8. Which of the following scales is not used in the energy equation proposed by Liu?
- macro - continuum
  - micro - primary inclusions
  - sub-micro - secondary inclusions
  - all of the above
9. Concerning micro-mechanisms, which material is still not well understood:
- steel
  - concrete
  - aluminum
  - copper
10. What is another interesting area that Liu's research can be applied to:
- fluid mechanics and the cardiovascular system
  - nanotechnology and the development of powerful microscopes
  - athletics and the development of protective gear
  - the food industry

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## ENGINEER INFORMATION

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