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ME 292 (JAN) 3:0
Contact and Impact Mechanics

Instructor(s): Debashish Das

Course description:
Brief overview of elasticity and linear-elastic fracture mechanics; point and line loading of an elastic half-space; frictionless contact mechanics of rigid and deformable bodies; force interactions between atoms and molecules (bonded and non-bonded short and long-range interactions); forces between particles and surfaces; capillary forces; adhesive contact mechanics; friction; application of contact mechanics in instrumented nanoindentation and atomic force microscopy; introduction to 1-D impact mechanics of elastic bodies; dynamic testing techniques; strain rate dependence of materials; latest research on contact and impact mechanics.

Prerequisites:
(ME-242/ME-293: Solid/Fracture Mechanics) or an equivalent course is desirable or the instructor's permission.

Resources:
- K. L. Johnson, Contact Mechanics, Cambridge University Press.
- J. N. Israelachvili, Intermolecular and surface forces, Academic Press, 3rd Edition.
- J.R. Barber, Contact Mechanics, Springer.
- T. L. Anderson, Fracture Mechanics: Fundamentals and Applications, CRC Press, 3rd Edition.
- C. L. Rao, V. Narayanamurthy, K. R. Y. Simha, Applied Impact Mechanics, John Wiley & Sons.
- B. Bhushan, Springer handbook of nanotechnology (Vol. 2, 2007). Berlin: Springer.
- I. Chasiotis, Atomic Force Microscopy in Solid Mechanics. In: Sharpe W. (eds) Springer Handbook of Experimental Solid Mechanics. Springer

Outcomes: After taking this course, the student/researcher will be able to understand the following:

- Application of contact mechanics to scanning-probe-microscopy techniques such as imaging with atomic force microscopes (AFM) and force spectroscopy.
- Application of the nanoindentation technique to extract material properties.
- Dynamic testing techniques to extract strain-rate dependent behavior of materials.

Additional information:

Target Audience (Interested students/researchers in the field of):

- Scanning-probe-microscopy and nanoindentation.
- Dynamic testing of materials (such as using Split-Hopkinson bars).
- Contact mechanics of deformable bodies.

Course website: