# CE598 – "Practical Peridynamics"
## Computational Solid Mechanics without the Stress and Strain
## 4:00 PM-5:15 PM Tuesdays and Thursdays, UNM Main Campus
## Fall Semester, 2015

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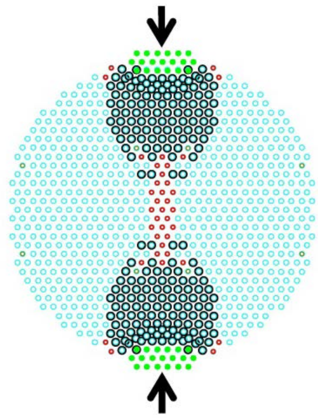

**Course Description**: Peridynamics provides an alternative to continuum mechanics. However, peridynamics is more general because it allows cracks to emerge.

Continuum mechanics assumes the material space is a continuous Cartesian real space. In contrast, in this course we assume the material space is a discrete Cartesian integer space, and proceed to develop the state-based peridynamic lattice model (SPLM).

With the SPLM, the forces between neighboring particles are characterized by a force state, T, and the stretches between particles are characterized by a deformation state, Y. The material model arises from a peridynamic function relating the force state to the deformation state. With the SPLM, continuous deformations, elasticity, damage, plasticity, cracks, and fragments can be simulated in a coherent and simple manner.

Much as Timoshenko brought the classical theory of elasticity to the practicing engineers, this course brings peridynamics to modern engineers, who with computers will be aided in solving previously unsolvable problems.

**Textbook**: Gerstle, W., "Practical Peridynamics: Computational Solid Mechanics without the Stress and Strain", World Scientific, 2015.

## Topics

1. Deformable Solids
   - 1.1 Difficulties with differential equations
   - 1.2 Classical solid mechanics
   - 1.3 Where classical solid mechanics fails
   - 1.4 Introduction to the peridynamic model
   - 1.5 What is a "solid material"?
   - 1.6 Geometric modeling of solids
   - 1.7 Digital aspects of geometric modeling
2. Beginnings of the Theory of Elasticity
   - 2.1 Brief history of solid mechanics
   - 2.2 Navier's treatise
   - 2.3 Discussion of Navier's paper
   - 2.4 Cauchy's treatise
3. Continuum Mechanics
   - 3.1 Newton, vectors, calculus, and continuity
   - 3.2 Vectors and tensors
   - 3.3 Kinematics
   - 3.4 Physical laws of mechanics and thermodynamics
   - 3.5 Traction and stress
   - 3.6 Constitutive relations
   - 3.7 Solving the continuum equations
4. Fracture Mechanics
   - 4.1 Historical overview of fracture mechanics
   - 4.2 Linear elastic fracture mechanics
   - 4.3 Griffith energy criterion
   - 4.4 Mixed-mode fracture propagation criteria
   - 4.5 Fatigue crack propagation
   - 4.6 Nonlinear fracture mechanics
   - 4.7 Computational fracture mechanics
   - 4.8 Conclusions regarding fracture mechanics
5. Bond-Based Continuum Peridynamics
   - 5.1 Introduction to the bond-based peridynamic theory
   - 5.2 Kinematics of the bond-based peridynamic theory