



VILLANOVA UNIVERSITY
**MECHANICAL ENGINEERING
DEPARTMENT**
Fall 2019 SEMINAR SERIES

Seminar Date: September 6th, 2019

Lecture: Exploiting the Malleability of Disorder to Design Mechanical Metamaterials

Speaker: Andrea Liu, Ph.D. Professor
Department of Physics, University of Pennsylvania

Abstract:

Disordered solids have far more variation in their properties than crystalline ones. This natural variation can be pushed even further by design, allowing us to tune in unusual properties and novel functions into materials. For example, when most materials are stretched in one direction, they tend to shrink in the orthogonal directions. Materials that expand in the orthogonal directions when stretched are “auxetic,” and have attracted attention for properties such as high energy absorption for applications. We have found that mechanical spring networks can be tuned easily to the extreme limit of auxetic behavior. Moreover, we have shown that complex properties common in living matter, such as the ability of proteins (e.g. hemoglobin) to change their conformations upon binding of an atom (oxygen) or molecule, the ability of the brain’s vascular network to send enhanced blood flow and oxygen to specific areas of the brain associated with a given task, or the ability to retain a memory, can be designed into disordered systems using similar principles.

Biography:



Dr. Andrea Liu is a theoretical soft and living matter physicist who received her A. B. and Ph.D. degrees in physics at the University of California, Berkeley, and Cornell University, respectively. She was a faculty member in the Department of Chemistry and Biochemistry at UCLA for ten years before joining the Department of Physics and Astronomy at the University of Pennsylvania in 2004. Liu is currently Speaker-Elect of the Council of the American Physical Society (APS) and Chair-Elect of the Physics Section of the American Association for the Advancement of Science (AAAS). She is a fellow of the APS, AAAS and the American Academy of Arts and Sciences, and a member of the National Academy of Sciences.

Host: Prof. David Cereceda