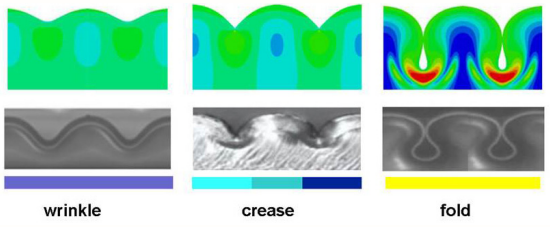
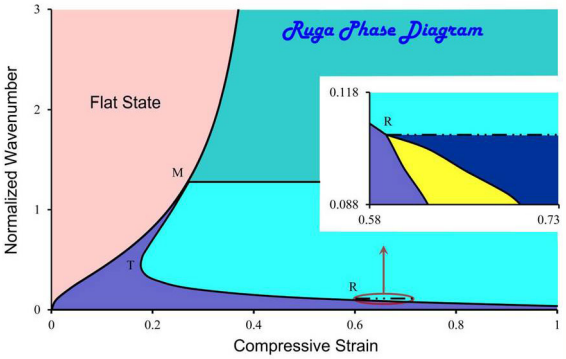
Thursday, September 19, 2013
2:00 - 3:00 p.m.
Room 1235, Howe Hall

AERO SPACE ENGINEERING

Search for New Multi-functional Materials with Ruga Mechanics



Professor Kyung-Suk Kim
Engineering, Brown University



The first half of the talk introduce mathematical analysis of sequential bifurcation processes in surface deformation of a neo-Hookean substrate with its elastic modulus exponentially decaying along the depth from its free surface. In turn, iso-periodic-compression Ruga Phase Diagram of neo-Hookean solids with their moduli exponentially decaying with depth has been constructed, and its implications on engineering multi-scale ruga structures are presented. In the second half of the talk, a new invention of dual-tip AFM interferometer (DT-AFMI) will be introduced. Then, it will be shown how the DT-AFMI is used to discover a static shock (strain discontinuity) in graphene, i.e. a crinkle ridge (a nano-ruga !). The static shock has its transition thickness of only 2.7nm. The crinkle ridge networks on graphite surfaces exhibit high protein adsorptivity; implications of the high protein adsorptcity on the function of an artificial graphite heart valve will be discussed as an application example.

Professor Kim has worked as an engineering scientist, inventor, and educator to contribute to a rapidly evolving society. His research interests are interdisciplinary - solid mechanics of small scale material structures, nano and micro-mechanics of solids in both experiment and theoretical modeling.
Through his research, he has invented numerous new scientific instruments and analytical methods, and he has recently initiated “ruga mechanics” as a new thrust in applied mechanics research.
As an educator, he has developed a number of innovative laboratory course materials, including “Bow and arrow dynamics”, “Wheel and suspension dynamics” and “Violin and bell dynamics” laboratory course materials. So far, he has advised 26 PhD students and Post Docs who are currently in academia or industries.
He is currently a board member and the secretary of the Society of Engineering Science.