Date: September 14th

Time: 11:00 AM

Location: Maryland Hall 110

Speaker: Dr. Qiang Zhu

Univ. of Cal. San Diego

Title: *"From Offshore Structures to Red Blood Cell Membrance: Examples of Fluid- Structure Interaction in Tethered Objects"*

Abstract

Fluid-structure interaction is an important problem in scientific explorations and engineering applications. In this presentation I will discuss two examples involving fluid and structural dynamics of tethered objects, a moored underwater buoy and a junctional complex (the basic unit in the protein skeleton that reinforces the membrane of a red blood cell). Despite the enormous difference in length scales (ranging from 1000m to 100nm), the two have very similar structural designs and mechanical properties. The implication is that they not only could be studied by using similar mathematical/numerical models, but also may shear key dynamical characteristics. In the moored-buoy case, our fluid-structure interaction model demonstrates that highly nonlinear mooring force owing to cable buckling leads to mode switching and chaotic behavior. The system subsequently generates a broadband free surface signature, which may make it detectable via surface wave patterns. In the second case, by using a molecular-detailed mesoscale model which is based upon the abovementioned cable-buoy model, we are able to correlate the mechanical response of the RBC membrane with its molecular architecture. Such knowledge is critical in understanding mutation-related cell malfunction and diseases. Our simulations also show that the molecular design of this biostructure, together with its interaction with surrounding fluids, will cause bifurcation and mode switching, which may explain recent experimental observations with microrheology techniques.