Scientific Computation Laboratory (S. Raha) has two broad PhD research topics and has opening for up to two PhD students for the Research Admission Interviews to be held in June 2016.

1) "Constrained Dynamics with Uncertainty over Complex Systems: Stabilization, Path-Constraints and Bifurcation Issues"
Stochastic differential/ differential-algebraic equations over inter-connected latticed structures, such as complex networks and hyper-graphs will be studied for stabilization, synchronization over given manifolds, prescribed trajectories and bifurcation due to structural behaviour in a common computational mathematical framework. Mathematical tools would include connections and distributions (differential geometry), nonlinear functional analysis, and stochastic calculus. Numerical algorithms and implementing them on heterogeneous computing platform (such as a multi-core server box with a GPU) will be the computational side. Application areas are in biochemical reaction networks, epidemiological dynamics, and power grid stabilization.

2) "Data Assimilation to Path Constrained Dynamical Systems."
For a differential-algebraic equation system, one needs to find out how to make a best estimate of its state, algebraic and parametric variables given a data output process. Non-linear filtering theory, DAE theory and some elementary differential geometry are the expected mathematical tools; while numerical integration and implementation on multi-core GPU equipped server/workstation is the computational tool. Application examples are: precise orbit estimation of navigation satellites, and uncertainty quantification of multibody dynamics (eg manufacturing robots, micro electro-mechanical systems etc) models.