The Department of Mechanical Engineering/College of Engineering and Applied Sciences
Stony Brook University

Mechanical Engineering Seminar

Faculty Candidate

Nilanjan Chakraborty PhD
Project Scientist at The Robotics Institute at Carnegie Mellon University in Pittsburgh, PA

Lecture Title: Optimization-based Algorithms for Dynamic Simulation and Kinodynamic Motion Planning

Tuesday, May 13, 2014 at 2PM, Room 173 Light Engineering Building

Abstract

Multibody systems interacting with each other in intermittent contact arises in a variety of robotic applications, e.g., manipulation, assembly planning, motion planning. Because of the intermittency of contact and the presence of stick-slip frictional behavior at the contacts, dynamic models of such multibody systems are mathematically nonlinear and nonsmooth, and are thus difficult to integrate stably and accurately to predict motion. The primary sources of stability and accuracy problems in state-of-the-art time steppers (numerical integrators) for multibody systems are the use of polyhedral representations of smooth bodies, the decoupling of collision detection from the solution of the dynamic time-stepping sub problem, linear approximations of quadratic Coulomb friction model, and errors in model parameters. In this talk, I will focus on (a) formulations, algorithm development, and analysis of time-steppers to eliminate the first three error sources and (b) developing efficient kinodynamic motion planning algorithms in cluttered environments that exploit the dynamics and geometric constraint satisfaction information obtained from the time-steppers. I will demonstrate that instead of studying the collision detection and state evolution of a robotic system as two separate problems (as is conventionally done in robotics), there are advantages to formulating them and solving them as a single problem (both for dynamic simulation and motion planning).

Biography

Nilanjan Chakraborty is a Project Scientist at The Robotics Institute at Carnegie Mellon University in Pittsburgh, PA. He received his Ph.D. from Rensselaer Polytechnic Institute in Troy, NY, and continued to a postdoc at Robotics Institute, CMU. He has won the best paper award at the Annual Proceedings of the Human Factors and Ergonomics Society (HFES) in 2013, and the best student paper award at Robotics: Science and Systems (RSS) in 2007. His research focuses on robot motion planning, multibody dynamics, multirobot (multiagent) coordination, and human interaction with multirobot systems.

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