DEPARTMENT OF
AEROSPACE ENGINEERING

DEPARTMENT OF AEROSPACE ENGINEERING SEMINAR SERIES

Geometric Mechanics and Controls on Nonlinear Manifolds for Complex Aerospace Systems

Thursday, October 25,2018 | 3:00pm - 4:00pm
2164 Martin Hall, DeWALT Seminar Room

Dr. Taeyoung Lee

Associate Professor
Department of Mechanical and Aerospace Engineering
George Washington University

ABSTRACT

Many interesting dynamic systems in science and engineering evolve on a nonlinear, or curved space that cannot be globally identified with a linear space. Such nonlinear spaces are referred to as manifolds, and they appear in various mechanical systems, such as a planar pendulum or a complex robotic system. However, geometric structures of a nonlinear manifold have not been carefully incorporated into control system engineering. Conventional nonlinear control systems based on local coordinates of a manifold suffer from singularities, ambiguities, and complexities, thereby severely restricting control performance.

This talk summarizes recent advances in geometric approaches for four major topics in nonlinear dynamics and controls, namely computational mechanics, optimization, feedback control, and estimation. It is shown that aggressive maneuvers of complex dynamic systems can be achieved in an intrinsic and elegant fashion, by constructing control systems directly on a manifold. The desirable properties of geometric mechanics and controls are illustrated by both computational and experimental results of several aerospace systems, including binary asteroid, formation reconfiguration of satellites, tethered spacecraft, and quadrotor unmanned aerial vehicles.

BIO

Dr. Taeyoung Lee is Associate Professor at the Department of Mechanical and Aerospace Engineering at the George Washington University, Washington DC. He received his doctoral degree in Aerospace Engineering, and his master's degree in Mathematics at the University of Michigan in 2008. His research interests include geometric mechanics, geometric control, optimization, estimation, and uncertainty propagation with applications to aerospace systems. His research has been supported by AFOSR, NASA, NRL, NSF, and ONR.

A. JAMES CLARK
SCHOOL OF ENGINEERING