Abstract

Many interesting dynamic systems in science and engineering evolve on a nonlinear, or curved, space that cannot be globally identified with a linear, or flat space. Such nonlinear spaces are referred to as manifolds, and they appear in various dynamic systems, varying from a simple pendulum to complex multibody systems. However, the geometric structures of a nonlinear manifold have not been extensively studied in control system engineering. The traditional nonlinear control systems based on local coordinates of a nonlinear manifold may exhibit singularities and complexities, and therefore, it is difficult to obtain global stability properties. This talk summarizes new geometric approaches for computational dynamics, optimization, feedback control, and estimation of mechanical systems evolving on a nonlinear manifold. By constructing a control system directly on a manifold in a coordinate-free fashion, we can control non-trivial, aggressive motion of complex dynamic systems globally over a long time period. The desirable properties of geometric approaches are demonstrated by several aerospace systems, such as formation reconfiguration of satellites, tethered spacecraft, and quadrotor UAVs.

Biography

Dr. Taeyoung Lee is an assistant professor with the Department of Mechanical and Aerospace Engineering at the George Washington University. He received his doctoral degree in Aerospace Engineering and his master’s degree in Mathematics at the University of Michigan in 2008. Before joining GWU in 2011, he was an assistant professor at the Florida Institute of Technology. His research interests include geometric mechanics, geometric nonlinear control, optimization, estimation, and computational mechanics with applications to aerospace systems, such as quadrotor UAV, tethered spacecraft, and satellite formation control. For his outstanding scholastic and research performance, he received the Distinguished Achievement Award and the Ivor K. McIvor Award from the University of Michigan. His research has been supported by the National Science Foundation, and the Air Force Office of Scientific Research, and he is currently member of IEEE, AIAA, and SIAM.