Ph.D. Defense

Benjamin León

(Advisor: Prof. Claudio Di Leo)

"Enabling Technologies for Autonomous Landing with Robotic Landing Gear"

Wednesday, March 25,
12 p.m
BlueJeans: https://bluejeans.com/614403656

Abstract:

Throughout their history, rotorcraft have proven to be an invaluable tool for accessing landscapes that traditional fixed wing aircraft are unable to reach. Pilots or autonomous flight systems often face the complexity of landing on uneven, rugged, or moving ship decks in order to complete their mission(s). Robotic, or articulating, landing gear (RLG) that use closed-loop feedback control are proven to expand the landing capabilities of rotorcraft on sloped and rough terrain, but they have not been experimentally proven on mobile landing surfaces. This thesis presents three enabling technologies that overcome limitations of modern experimental RLG. These technologies include a cable-driven four-bar link mechanism, an elastomer encapsulated pressure sensor used for force sensing, and a fault tolerant, sensor-fused control algorithm. The new four-bar mechanism is shown to expand the sloped landing capabilities of rotorcraft and withstand hard impact forces. The second technology is a low force, large deformation force sensor with high sensitivity. It is designed through analytic methods, and those methods are validated using experiments. Generalized design principles are generated for the sensor before a specific design procedure ensues for RLG applications. The final technology, a sensor-fused controller, is designed to add fuselage orientation controllability on real-world systems. All three technologies subsequently integrate into a commercial helicopter for validation in relevant operational environments. Experimental ground tests include static, sloped surfaces and dynamic motion platforms that recreate rough Sea State conditions. Limited flight testing and results are also provided as validation of the technology's applicability for applied systems. Finally, extended multibody dynamic simulations of the aircraft, landing gear, and new control system show the benefits of this fused feedback approach in the toughest landing conditions.

Committee:

· Prof. Claudio Di Leo – School of Aerospace Engineering, Georgia Institute of Technology
· Prof. Julian J. Rimoli– School of Aerospace Engineering, Georgia Institute of Technology
· Prof. Jonathan Rogers – School of Aerospace Engineering, Georgia Institute of Technology
· Prof. William Singhose – School of Mechanical Engineering, Georgia Institute of Technology
· Dr. Ashish Bagai – Principal, buGi Aero, LL