Control of Two Autonomous Helicopters Carrying One Load

by

Marcos Berrios

Helicopters play a vital role in moving cargo from point to point. Whether the application is industrial, military, or humanitarian, there is often no other practical way to deliver material or equipment to remote locations. Cargo missions of the near future will require transportation of increasingly heavy loads to remote locations that are at distances farther, and at altitudes higher, than what can be accomplished by current helicopters. One solution is to build larger aircraft, but a practical size limit is quickly reached when evaluating the return-on-investment of designing, building, and operating a specialized heavy-lift vehicle. Another solution is to use two helicopters to carry a single load, termed dual lift. This approach provides heavy lift on demand and avoids the costs associated with developing a new special purpose heavy lift helicopter.

This research effort seeks to gain a fundamental understanding of the multi-body flight control challenges present in a helicopter dual lift system. Given a reference trajectory for the payload, the dual lift controller will maneuver the helicopters so that the load follows the prescribed trajectory while ensuring stability and minimizing an objective function consisting of parameters such as total thrust, fuel consumption, and load distribution. Dynamic models and flight control strategies will be validated via wind tunnel experiments (1/11th scale) and in flight using two medium-sized (10 ft rotor diameter) autonomous RMAX helicopters.