HeLion – Autonomous Unmanned Rotorcraft

Figure 1: HeLion in autonomous hovering flight

HeLion is a first generation rotorcraft built as part of the Unmanned Aerial Vehicle (UAV) helicopter family in the National University of Singapore (NUS). HeLion was constructed with a few objectives in mind. It has to achieve (1) long ranged, high endurance autonomous flight; (2) transfer of flight data from onboard sensors and images to the ground station; (3) execution of flight control for a myriad of flying formations, e.g. slalom and pirouette flight; (4) peer to peer and point to multi-point communication between multiple UAVs in formation flight.

With such objectives in mind, HeLion's construction began with a 3D model drawn using Solidworks before the purchasing of its hardware. Its fuselage was chosen from a high-quality hobby radio-controlled (RC) Raptor 90 SE helicopter. The Raptor 90 SE was chosen based on its great manoeuvrability, payload and great structural design.

Figure 2: Raptor 90 SE Helicopter and its virtual counterpart

A sophisticated avionic system was constructed using a systematic design methodology created by the NUS UAV Team. The avionic system consists of the following five parts: (a) PC-104 computer processor boards; (b) avionic sensors including INS/GPS, ultrasonic sonar and RPM sensor; (c) servo controllers; (d) wireless modem; and (e) Li-Po batteries. Special attention has been paid to the anti-vibration and anti-pollution factors during its construction procedure.

HeLion is an ideal platform for advanced control law implementation and evaluation. It can perform reliable automatic flight in the full flight envelope including automatic taking-off and landing. As HeLion is a key member of the multiple UAV formation control project, there is a need to upgrade the wireless modem previously used with the Acksys (WLg-LINK-OEM) WiFi Module. The Acksys WiFi module boasts a large line-of-sight range with high data throughput of 25 Mbps. It is compact, reliable and can provide high-powered wireless data transmission. On top of these, the module is also able to run on the QNX operating system. This is a perfect fit for the HeLion as the next objective of the HeLion was to achieve remote monitoring, control and video down-streaming among multiple UAVs.

The NUS UAV Team would like to thank Acksys Communications & Systems for their support with their EVAL WiFi module kits in the advancement of research in UAVs.

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