

Development and testing of open-jet wind tunnel for quadrotor flight testing

ABSTRACT

Station keeping of a hovering quadrotor under various turbulent wind condition has gained much attention these days due to its potential application in complex environments. Various types of control algorithm have been developed to increase the performance of the quadrotor under such wind conditions. These need to be tested and verified by flying the quadrotor itself. One of the quick and low-cost solutions would be to set up a test rig by modifying an existing wind tunnel to recreate such wind conditions. In order to cater such experiments, in Universiti Putra Malaysia (UPM), an open-jet wind tunnel was attached to an existing open-loop wind tunnel, which initially has a test area of 1 meter by 1-meter size. By attaching the open-jet wind tunnel which has a diverged shape, the test section area is increased up to 2 meters in diameter size, ensuring sufficient space for manoeuvring and hovering the experimental quadrotor. A settling chamber is attached before the test section to characterize the output wind. The maximum wind speed at the opening is 8 m/s. The extended wind tunnel's flow characteristics are analyzed by anemometer for velocity distribution in four different distance from the opening. It has been found that the wind velocity distribution and turbulent intensity simulate the outdoor wind turbulent condition to test a quadrotor hovering control algorithm.

Keyword: Open-jet wind tunnel; Wind distribution; Wind speed; Quadrotor testing; Unmanned aerial vehicle