Abstract ID 437

ANALYSIS OF COAXIAL PROPULSION SYSTEM CONFIGURATIONS FOR A MULTIROTOR UNNAMED AERIAL VEHICLE APPLICATION

Aníbal Valido[(1)], Nuno Pereira[(2)], Nuno Nunes[(3)], Paulo Moita[(1)], Ricardo Silva[(4)], Rodrigo Alpalhão[(4)], Tiago Ramalho[(5)], António Relvas[(5)], Ricardo Cláudio[(6)]

[(1)]DICE Lab - Escola Superior de Tecnologia de Setúbal, Instituto Politécnico de Setúbal, Setúbal, Portugal/CENTEC, Instituto Superior Técnico, Universidade de Lisboa, Av. Rovisco Pais, 1049-001 Lisboa, Portugal
[(2)]Escola Superior de Tecnologia de Setúbal, Instituto Politécnico de Setúbal, Setúbal, Portugal, Lisboa, Portugal
[(3)]DICE Lab - Escola Superior de Tecnologia de Setúbal, Instituto Politécnico de Setúbal, Setúbal, Portugal
[(4)]Escola Superior de Tecnologia de Setúbal, Instituto Politécnico de Setúbal, Setúbal, Portugal
[(5)]Tekever Uas, S.A.
[(6)]DICE Lab - Escola Superior de Tecnologia de Setúbal, Instituto Politécnico de Setúbal, Setúbal, Portugal/IDMEC, Instituto Superior Técnico, Universidade de Lisboa, Av. Rovisco Pais, 1049-001 Lisboa, Portugal

anibal.valido@estsetubal.ips.pt, nuno.pereira@estsetubal.ips.pt, nuno.nunes@estsetubal.ips.pt, paulo.moita@estsetubal.ips.pt, ricardo.silva@estsetubal.ips.pt, rodrigo.alpalhao@estsetubal.ips.pt, tiago.ramalho@tekever.com, antonio.relvas@tekever.com, ricardo.claudio@estsetubal.ips.pt

Keywords: Coaxial, multirotor, unnamed aerial vehicle, test bench

Summary: Multirotor unmanned aerial vehicles are revolutionizing transportation and transforming how many missions are accomplished, offering fast and efficient solutions for deliveries, inspection, monitoring, and aerial photography, among other applications. This work is related to the study of the using of different propeller sets in a coaxial propulsion system for a multirotor unnamed aerial vehicle application. A coaxial arrangement refers to a propulsion system where two propellers are mounted on the same axis (coaxial) but rotate in opposite directions to counteract torque effects and improve stability. In a coaxial propulsion system, the airflow from the upper propeller can interfere with the lower propeller, slightly reducing overall efficiency, however, it is commonly used since the unnamed aerial vehicle becomes much more compact. The use of coaxial propulsion systems allows for more efficient use of space, making it ideal for applications where size and weight constraints are critical. The main objective of this work was to determine the best set of propellers for a specific motor, considering previously defined criteria such as the best power efficiency and the lowest coaxial loss in terms of trust.

A test bench was developed, consisting of an aluminum tube instrumented with strain gauges formed a full-bridge configuration, and signal acquisition equipment, was built to carry out the tests, that in combination with appropriate electronic speed control allows to monitor all the required characteristics of the system. A set of tests were planned, considering propulsion system with motors T-Motor Antigravity MN5008 340KV. Tests were carried out with a single propeller, with an inverted single propeller and double propellers (coaxial system), with different sizes and arrangements.

The findings of this work help UAV designers to identify and size the best solution for coaxial propulsion systems, contributing to the development of more efficient and compact multirotor UAV platforms.