

# Design of a quadrotor flight test stand for system identification

**M. M. Beharie**

**milanb@csir.co.za**

UW-CSIR

Pretoria

South Africa

**J. O. Pedro**

**jimoh.pedro@wits.ac.za**

School of Mechanical, Industrial and Aeronautical Engineering

University of the Witwatersrand

Johannesburg

South Africa

**L. Dala**

**ldala1@csir.co.za**

UP-CSIR Aeronautics Chair

Pretoria

South Africa

## ABSTRACT

This paper presents the design, development and construction of a flight test stand for a quadrotor UAV. As opposed to alternate forms of UAV, the power plant in the case of the quadrotor serves a dual purpose of control and propulsion. Since control and propulsion are coupled, the power plant (BLDC motor coupled with propeller) was studied in detail using a black box structure. Extractions of motor parameters in previous studies used traditional BLDC motor equations and propeller theory however the accuracy achievable and confidence in the extracted parameters remained questionable. The developed data acquisition process served to satisfy this need by the construction of a test bench that allows for the extraction of the unknown parameters instilling confidence in the modelling process. The established relationships are then used as inputs into a developed six degree of freedom Euler based mathematical model. A mission profile was constructed with distinct phases of which the mathematical model was used to simulate. Each phase in the mission profile excited different modes of the quadrotor dynamics creating an ideal simulation environment in which changes can be implemented and studied.