Development of Test Bed for Ground Multi-DOF Dynamic Structural Testing of Fixed-Wing UAVs

Description

The increasing complexity of fixed-wing Unmanned Aerial Vehicles (UAVs) and their applications in various fields, including logistics, and environmental monitoring, necessitate advanced testing methodologies to ensure safety, durability, and performance. Ground-based multi-degree-of-freedom (DOF) dynamic structural testing provides an efficient and controlled environment to simulate real-world conditions and assess the dynamic behavior of UAV structures. This thesis aims to develop a dedicated test bed for ground-based multi-DOF dynamic testing of fixed-wing UAVs, incorporating advanced actuation, measurement, and analysis techniques.

The test bed will be designed to replicate dynamic loads experienced during flight conditions, including aerodynamic, inertial, and operational stresses. The developed system will facilitate the testing of UAV structural components under both static and dynamic conditions, with a focus on modal analysis, fatigue testing, and failure mode analysis.

Key Objectives:

- Design and develop a modular test bed capable of applying multi-DOF dynamic loads to fixed-wing UAV structures.
- Implement advanced measurement systems, including strain gauges, accelerometers, and motion capture technology, to accurately monitor the structural response.
- Perform dynamic simulations to predict structural behavior and validate experimental results.
- Develop data acquisition and processing tools using Python and MATLAB for real-time analysis and visualization.
- Evaluate UAV structural components under varying load conditions, focusing on critical failure modes and structural integrity.

Related Scientific fields

- Structural Dynamics
- Aerospace Engineering
- Modal Analysis
- Experimental Mechanics
- Data Acquisition and Signal Processing

Tools that will probably be used

Software:

- Matlab
- Python
- Solidworks
- LabVIEW
- ANSYS

Hardware:

- Actuators and controllers for dynamic load application
- Measurement sensors (strain gauges, accelerometers)
- Data acquisition systems

Any other specification

The project aims to publish at least one paper in a highly ranked international journal.

Supervisor and Partners:

- Prof. V. Spitas, Dr. C. Kalligeros

END NOTE

Relevant information regarding this thesis research project is provided in the same folder as this document. For further details or inquiries, please feel free to contact us through the email provided.

If you have additional ideas or suggestions, we encourage you to share them by sending an email to the same contact. While it is preferred that some preliminary study is undertaken before reaching out, it is not mandatory. We value your input and look forward to your contributions.