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MECHANICAL DECOUPLING OF EXPERIMENTS FROM STRUCTURAL VIBRATIONS AND SYSTEMATIC RESIDUAL ACCELERATIONS ON SMALL AIRPLANES USED AS MICROGRAVITYPLATFORM

Abstract

Small Aircrafts as Microgravityplatforms offer many advantages compared to other platforms as are high flexibility and repetition rates with access to the experiment, mounting positions close to the center of gravity of the plane and very competitive prices. Drawbacks are the relatively short microgravity time and the high level of structural vibrations.

As the residual acceleration level of small planes during parabolic fights are not comprehensively investigated and strongly depend on the type of aircraft a measurement strategy based on acceleration sensors and wavelet analyses has been developed. Therewith structural vibrations and systematic accelerations of the engines and the flight path of the plane were identified and assesed with regard to mechanical decoupling systems for experiments.

Among other investigations these measurements enabled an optimization of the control strategy and the flight paths. After several test flights the realistic potential of small aircrafts as microgravity platforms has been reevaluated.Based on these experiences a design strategy for mechanical decoupling systems concerning structural vibrations as well as systematic accelerations has been developed. Measurements with decoupled sensors show the potential and the effectiveness of this design strategy.

In this paper these measurements and the new design strategy are presented in detail. Passive decoupling systems for microgravity applications on small aircrafts based on this new approach have been investigated and the combination with the platform evaluated regarding its applicability.