Bachelor thesis

Dynamic simulation of the general aviation aircraft PZL-130 Orlik main landing gear

Tomasz Bartkowiak

Aerospace Engineering, Propulsion Systems

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Supervisor: dr hab. inż. Marek Wojtyra

1. Introduction

The Engineering Thesis “Dynamic simulation of the general aviation aircraft PZL-130 Orlik main landing gear” created in cooperation with PZL EADS Airbus Military „Warszawa-Okęcie” S.A., focuses on developing a simulation model of the PZL-130 Orlik aircraft main landing gear, that could potentially be used as a quick, easy and time-saving substitute for experimental tests and be able to reveal the most important dynamic and kinematic parameters of a main landing gear during touchdown, for various initial conditions, including aircraft mass, velocity components and lift force. Reliable and accurate simulation model is an inexpressibly helpful tool for pilots and engineers when conducting various analysis that very often could be impossible or very hard to be done experimentally.

2. Thesis objectives

Assumptions and main objectives

The main objective of the thesis was to create three simulation models of PZL-130 Orlik main landing gear in MSC. ADAMS – two static (transient models) and one, complete dynamic aircraft model and compare the results with the experimental data provided by the Polish Institute of Aviation. Mathematical models of a shock absorber and a landing gear tire were also derived.

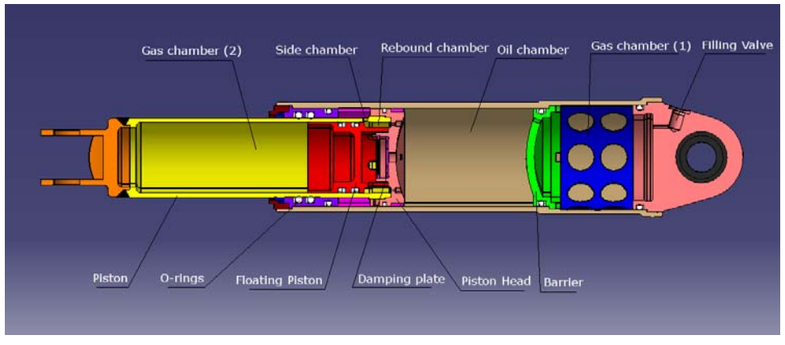

Figure: Shock absorber cross section

3. Results

The results matched experimental data in case of both quasi-static and dynamic tests.

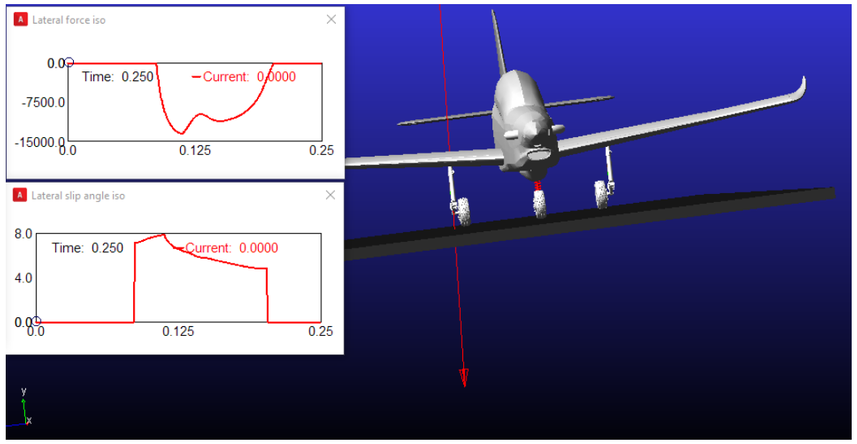

Figure: Complete aircraft model in MSC.ADAMS

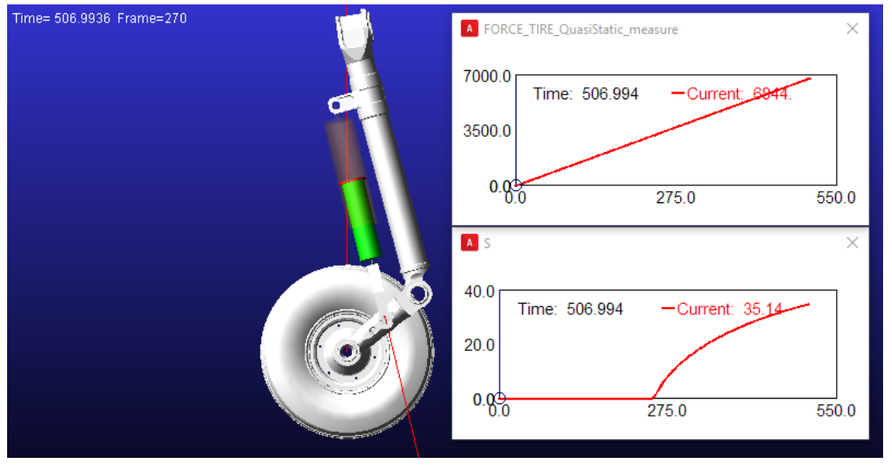

Figure: Landing gear quasi-static test

4. Conclusions

Dynamic model presented in this work allows for a fast, coarse estimation of load factors, accelerations and forces acting on a landing gear during touchdown for various initial conditions including aircraft mass, lift force and velocity components (i.e. Asymmetric landing with lateral velocity case) . This information might be essential when experimental data cannot be obtained or is very difficult to be obtained due to time or financial restrictions. Accuracy in both static and dynamic analysis ensures that the model reflects reality during the first fractions of seconds after touchdown, when the forces acting on the landing gear are the greatest and stresses associated with them -the most dangerous.

FACULTY OF POWER AND AERONAUTICAL ENGINEERING
WARSAW UNIVERSITY OF TECHNOLOGY
www.meil.pw.edu.pl

DIVISION OF THEORY OF MACHINES AND ROBOTS
INSTITUTE OF AERONAUTICS AND APPLIED MECHANICS
ztmir.meil.pw.edu.pl