JAVA FRAMEWORK FOR PARAMETRIC AIRCRAFT DESIGN – GROUND PERFORMANCE

Abstract

Purpose – This paper introduces the take-off and landing performance analysis modules of the software library named JPAD (Java toolchain of Programs for Aircraft Design), dedicated to the aircraft preliminary design. An overview of JPAD is also presented.

Design/methodology/approach – The calculation of the take-off and landing distances have been implemented using a simulation-based approach. This expects to solve an appropriate set of ordinary differential equations (ODE), which describes the aircraft equations of motion during all the take-off and landing phases. Tests upon two aircraft models (ATR72 and B747-100B) have been performed in order to compare the obtained output with the performance data retrieved from the related flight manuals.

Findings – The tool developed has proven to be very reliable and versatile as it performs the calculation of the required performance with almost no computational effort and with a good accuracy, providing a less than the 5% difference with respect to the statistical trend and a difference from the flight manual or public brochure data around 10%.

Originality/value – The use of a simulation-based approach in order to have a more accurate estimation of the ground performance with respect to classic semi-empirical equations. Although performing the simulation of the aircraft motion, the approach shown is very time-saving and can be easily implemented in an optimization cycle.

Introduction

This paper introduces a versatile, accurate and rapid calculation tool for estimating the ground performance of a generic aircraft parametric model. This tool has been also used within the framework of the European project AGILE (AGILE, 2017) and is part of a more complex open-source Java library named JPAD (Java toolchain of Programs for Aircraft Design) in development at University of Naples. This library is designed as a fast, reliable and user friendly computational aid for aircraft designers in the conceptual and preliminary design phases.

The ultimate goal of JPAD is to perform parametric and multi-disciplinary analyses of an aircraft and then search for an optimized configuration. A computational framework capable to rapidly find an optimal configuration, satisfying several basic requirements, would be an essential tool for industrial aircraft designers. In this perspective, the take-off and landing calculation modules discussed in this article can be easily used as design tools for performance optimizations with respect