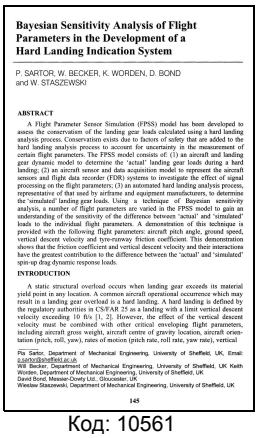

Bayesian Sensitivity Analysis of Flight Parameters in the Development of a Hard Landing Indication System

P. SARTOR, W. BECKER, K. WORDEN, D. BOND and W. STASZEWSKI

ABSTRACT

A Flight Parameter Sensor Simulation (FPSS) model has been developed to assess the conservatism of the landing gear loads calculated using a hard landing analysis process. Conservatism exists due to factors of safety that are added to the hard landing analysis process to account for uncertainty in the measurement of certain flight parameters. The FPSS model consists of: (1) an aircraft and landing gear dynamic model to determine the 'actual' landing gear loads during a hard landing; (2) an aircraft sensor and data acquisition model to represent the aircraft sensors and flight data recorder (FDR) systems to investigate the effect of signal processing on the flight parameters; (3) an automated hard landing analysis process, representative of that used by airframe and equipment manufacturers, to determine the 'simulated' landing gear loads. Using a technique of Bayesian sensitivity analysis, a number of flight parameters are varied in the FPSS model to gain an understanding of the sensitivity of the difference between 'actual' and 'simulated' loads to the individual flight parameters. A demonstration of this technique is provided with the following flight parameters: aircraft pitch angle, ground speed, vertical descent velocity and tyre-runway friction coefficient. This demonstration shows that the friction coefficient and vertical descent velocity and their interactions have the greatest contribution to the difference between the 'actual' and 'simulated' spin-up drag dynamic response loads.

INTRODUCTION

A static structural overload occurs when landing gear exceeds its material yield point in any location. A common aircraft operational occurrence which may result in a landing gear overload is a hard landing. A hard landing is defined by the regulatory authorities in CS/FAR 25 as a landing with a limit vertical descent velocity exceeding 10 ft/s [1, 2]. However, the effect of the vertical descent velocity must be combined with other critical enveloping flight parameters, including aircraft gross weight, aircraft centre of gravity location, aircraft orientation (pitch, roll, yaw), rates of motion (pitch rate, roll rate, yaw rate), vertical

Pia Sartor, Department of Mechanical Engineering, University of Sheffield, UK, Email: p.sartor@sheffield.ac.uk
Wes Becker, Department of Mechanical Engineering, University of Sheffield, UK Keith Worden, Department of Mechanical Engineering, University of Sheffield, UK
David Bond, Messier-Dowty Ltd., Gloucester, UK
Wieslaw Staszewski, Department of Mechanical Engineering, University of Sheffield, UK

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P. Sartor, W. Becker, K. Worden, D. Bond, W. Staszewski

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Ключевые слова:

Содержание.