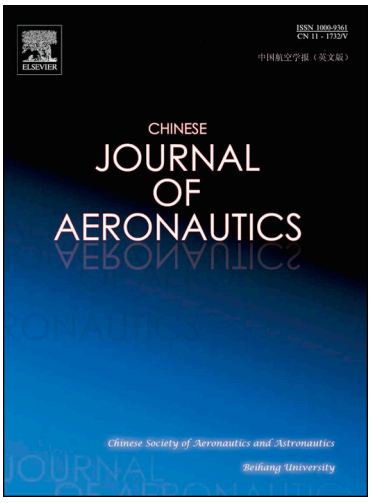

Review Article

A novel integrated self-powered brake system for more electric aircraft

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PII: S1000-9361(17)30262-5
DOI: https://doi.org/10.1016/j.cja.2017.11.015
Reference: CJA 945

To appear in: *Chinese Journal of Aeronautics*

Received Date: 30 March 2017
Revised Date: 21 June 2017
Accepted Date: 5 September 2017

Please cite this article as: Y. Shang, X. Liu, Z. Jiao, S. Wu, A novel integrated self-powered brake system for more electric aircraft, *Chinese Journal of Aeronautics* (2017), doi: https://doi.org/10.1016/j.cja.2017.11.015

Chinese Journal of Aeronautics xx (2017) xx-xx

Contents lists available at ScienceDirect

Chinese Journal of Aeronautics

journal homepage: www.elsevier.com/locate/cja

A novel integrated self-powered brake system for more electric aircraft

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Received 30 March 2017; revised 21 June 2017; accepted 5 September 2017

Abstract

Traditional hydraulic brake systems require a complex system of pipelines between an aircraft engine driven pump (EDP) and brake actuators, which increases the weight of the aircraft and may even cause serious vibration and leakage problems. In order to improve the reliability and safety of more electric aircraft (MEA), this paper proposes a new integrated self-powered brake system (ISBS) for MEA. It uses a hydraulic pump geared to the main wheel to recover a small part of the kinetic energy of a landing aircraft. The recovered energy then serves as the hydraulic power supply for brake actuators. It does not require additional hydraulic source, thus removing the pipelines between an EDP and brake actuators. In addition, its self-powered characteristic makes it possible to brake as usual even in an emergency situation when the airborne power is lost. This paper introduces the working principle of the ISBS and presents a prototype. The mathematical models of a taxiing aircraft and the ISBS are established. A feedback linearization control algorithm is designed to fulfill the anti-skid control. Simulations are carried out to verify the feasibility of the ISBS, and experiments are conducted on a ground inertia brake test bench. The ISBS presents a good performance and provides a new potential solution in the field of brake systems for MEA.

Keywords: Hydraulic; Novel brake system; Self-powered; Feedback linearization control; More Electric Aircraft;

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1. Introduction[1]

Aircraft brake systems play a major role during aircraft take-off and landing. Their major functions include anti-skid brake, brake during the take-off, and brake after the full retraction of landing gears. [1,2] Hydraulic brake systems are widely applied in an aircraft due to their high power density and robustness, and the fact that they use the same hydraulic power supply as for the primary flight control system. An engine driven pump (EDP) supplies high-pressure oil to brake actuators through a complex system of pipelines. [3] A pressure control servo-valve is typically used in these circumstances, and is located near a landing gear. [4] The length of pipelines between the EDP and brake actuators is generally between 8 and 10 meters, and can go up to 20 meters in the case of a large aircraft. In order to improve the system reliability, double redundancy is typically utilized. These complex pipelines and