

On the Reliability of Operation of Aircraft Integrated Electro-Hydraulic Servo Actuator

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Abstract

The use of the Fly-by-Wire (FBW) systems for flight control of aeronautical vehicles has increased steadily in the recent years. Such systems use electro-hydraulic servo-actuators to position the maneuvering surfaces of airplanes or movable thrust vector controls of space vehicles. The marriage between electronics and hydraulic power systems has led to many powerful and precise control systems, saving much energy and money. This paper deals with the reliability of operation of an integrated electro-hydraulic servo-actuator (ISA) via development of a detailed nonlinear mathematical model and a computer simulation program using MATLAB/SIMULINK package. The ISA mainly consists of two separate active hydraulic power systems, used to supply the ISA with the required power. The studied ISA incorporates two electro-hydraulic servo-valves, a twin-symmetrical-hydraulic cylinder, and a smart design of built in directional control valves with a feedback system. The ISA is designed with smart capability to over-ride the possible problems of failure of any of the power supply systems or any of the servo-valves. The transient response of the ISA is calculated and analyzed in different operating modes with possible defects. The simulation results showed that the ISA presented has an acceptable transient response. The system stability and precision could be insured by the implementation of convenient controllers.

Key words: Fly-by-Wire System (FBW), Integrated Servo Actuator (ISA), Servo-Valve, Directional Control Valve, Transient Response, Convenient Controller.

Image

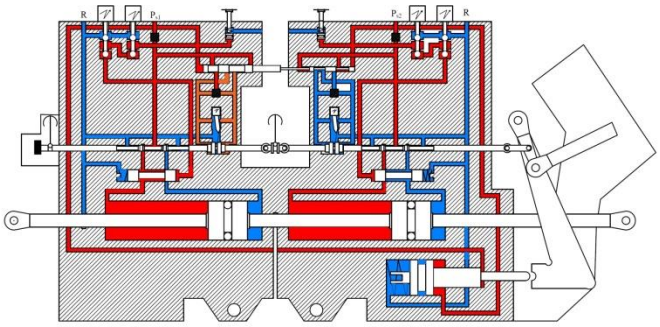


Figure: Integrated Electro-Hydraulic Servo Actuator Scheme

Recent Publications

1- M. Zaki Fadel, M. Galal Rabie, and A. M. Youssef, "Investigation of the Operation of an Electro-Hydraulic Control System of a flying vehicle under failure conditions", Proceedings of the 18th AMME International Conference, MTC, Cairo, Egypt, April 3-5, 2018.

Biography

Mohamed Zaki Fadel is a teaching assistant in the aircraft mechanics department in Military Technical College (MTC). He has great experience in Hydraulic control systems. He works at many researches and Technical reports and committees.

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