

The research of Aircraft Structure Health Monitoring System based on big data analysis

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The Structure Health Monitoring System(SHMS) is an important and system for the old age or future aircrafts. The main components of this system includes many new and advanced sensors like fiber optic sensor etc.in the principal structure elements of aircraft structures, and the data processing module which needs to collect and demodulate the massive data, and the data analysis and storage which can be used to predict the structure life and evaluate the health status of the whole aircraft.

This paper introduces the concept and functions of the SHMS, and present the state-of-the-art for SHMS all around of China, and the development history of SHM and aircraft life management during the past several decades. As the technology of big data analysis and cloud computing become more and more mature, a new research direction has been proposed in this paper.

This paper provides the operating principle of SHMS and the flow of big data including the data collection and analysis and management. The system frame design method is proposed, and both of software and hardware conception also be described in this paper. The main functions and maintenance of SHMS also be discussed for the system design.

Last but not the least, this paper provides the assumption that the aircraft structure life follows the lognormal distribution and the research on comparison between the aircraft structure life with and without structure health monitoring system. The analysis result shows that the aircraft use life and average life grows as the reliability of structure health monitoring grows and the aircraft structure maintenance become more effective as followed the table 1.

Table 1 the effect on safe life in air fleet depends on different reliability of SHMS

The reliability of SHMS	The proportion of air fleet for design safe life	the life of air fleet used SHMS/fh	The proportion of life increase
70%	99.567%	2050.4	16.87%
80%	99.350%	2161.3	23.20%
90%	98.700%	2401.4	36.89%
95%	97.400%	2690.0	53.30%
99%	87.000%	3750.4	113.78%

This paper assumes the average life of air fleet is 10000 flight hours.

Keywords: Structure health monitoring system, Big data analysis, Degree of reliability