SPACE PROPULSION SYMPOSIUM (C4)
Propulsion Technology (3)

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# A SURVEY OF THE HEALTH MONITORING TECHNOLOGY FOR LIQUID-PROPELLANT ROCKET ENGINES

**Abstract**

Health monitoring is very important to improve and enhance the reliability and safety of current one-off and next-generation reusable liquid-propellant rocket engines. Its key technologies will be summarized in this paper. The main aspects of health monitoring such as algorithms of fault detection and diagnosis, system frameworks and control means will all be illustrated in detail. Firstly, the fault detection and diagnosis algorithms will be analyzed and then be classified into the certain and uncertain kinds. This is due to the intrinsical uncertainty existed in the fault detection and diagnosis, especially in the absence of prerequisite knowledge and sufficient sample data. Secondly, functional requirements of health monitoring systems and the main current usable systems will be described and discussed. Then a layered, open and reusable framework of health monitoring systems will be investigated based on the data-model-view-control hierarchy and the ability in the loose coupling of system structure and function modules. Thirdly, current control means of liquid-propellant rocket engines will be discussed and analyzed in which the new damage-mitigating control technology will be espcially emphasized. It is able to improve the structural durability of critical components and extend the service life of reusable engines by achieving a desired trade-off between the damage of critical components and the performance of engines. At last, the evolution trend of health monitoring techniques of liquid-propellant rocket engines will be set out. Some key technologies such as the preflight integrated performance test, the real-time flight data recording and the postflight structural detection will also be prospected preliminary, which can be used in the health management of the whole life-cycle for reusable engines.