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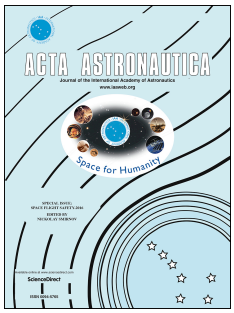

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Fault Detection and Diagnosis Algorithms for an Open-Cycle Liquid Propellant Rocket Engine using the Kalman Filter and Fault Factor Methods

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Abstract

This paper deals with applications of fault detection and diagnosis algorithms based on the Kalman filter and fault factor method for an open-cycle liquid propellant rocket engine in a steady state. In order to develop the algorithms, we designed the Kalman filter with a linearized model of a liquid propellant rocket engine and energy balance equations with fault factors. To confirm the fault detection and diagnosis algorithms, we developed a mathematical model of an open-cycle liquid propellant rocket engine and artificially injected various faults, such as decreasing turbine efficiency and a sensor fault. We then executed the fault detection and diagnosis algorithms and analyzed the results of each algorithm. These processes are numerically demonstrated for the open-cycle liquid propellant rocket engine at full thrust level by using the simulated measurement data of the liquid propellant rocket engine mathematical model.

Keywords: Open-Cycle Liquid Propellant Rocket Engine, Fault Detection and Diagnosis, Kalman Filter, Fault Factor, Numerical Simulation

Nomenclature

CFCV	Combustion chamber Fuel Control Valve
GOCV	Gas generator Oxidizer Control Valve
GFCV	Gas generator Fuel Control Valve
ω	The angular velocity