Mathematical simulation of the cyclic mode of operation for a liquid propellant spacecraft rocket engine

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The paper describes a mathematical model concerning operation of a monopropellant rocket engine used in its cyclic mode of operation that takes into account the stages of the engine entering the steady-state operation mode and thrust decay. We present required test firing procedure and results for two test engine samples enabling us to obtain their cyclic mode operation characteristics. We describe the steps to derive approximation factors for test firing data so that an autonomous computation routine may be implemented on board, calculating engine thrust and specific impulse as functions of current fuel pressure in the tank and work cycle duration. We estimated the accuracy of data approximation and stated the guidelines for how to obtain and use test firing data and determine how much data is required in order to ensure highly accurate spacecraft manoeuvring both for continuous-duty and pulse-like engine operation modes.

Keywords: *spacecraft, rocket engine, mathematical simulation, cyclic mode of operation, rocket engine test firing, approximation factors, steady-state mode onset, thrust decay*

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