Development ideas of a liquid carrier-rocket propellant level gauge using optical fiber lines

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In modern space engineering, it is necessary to provide minimal fuel and energy consumption while providing high level of reliability for launching a payload to the required orbit. Development of a precise and linear level gauge of the fuel consumption control system can solve a part of the problem. Both the continuous monitoring and guiding the fuel component consumption make it possible to synchronize tanks discharging more precisely and loss-free. It also allows getting rid of the fuel safety stocks in the tanks in case of their full discharge, with the same fuel components launch mass being maintained. Thus, it gives a boost to the carrier-rocket. In this case, a particular physical approach is applied to solving the technical problem, which consists of using both physical properties of optical fiber and the impact of cable local deformations on the backscatter phenomenon. A new level gauge is introduced for LRE fuel consumption management system, which is based on the distributed control fluid sensor located in rocket fuel tank. The concept of this fuel consumption management system is described. It allows for an increase in LRE power characteristics. We examined some existing linear tracking systems as well as fuel consumption synchronization systems of liquid carrier-rockets. We justified the choice of optical fiber cable for a level gauge and provided a level gauge hardware flowchart. Furthermore, we carried out the comparative analysis of the described physical method with a hypothetical analogue of a level gauge for LRE fuel consumption control system.

Keywords: *carrier-rocket, fuel consumption control system, optical fiber lines, level gauge*

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