Research on Calibration Device Using Plunger Metering Cylinder for Turbine Flowmeter

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Accurate fuel rate acquisition is one of the basic requirements to improve the reliability and confidence of testing results for aero-engines. Because of its high precision and good repeatability, turbine flowmeter is widely used in flow measurement of fuel or oil system. However, due to the influence of wear and corrosion, the meter coefficient is bound to change. To accurately evaluate the current meter coefficient of turbine flowmeter, we developed a calibration device using a plunger metering cylinder for turbine flowmeter. Considering the mathematical model of turbine flowmeter, the stability of fuel pushing was researched through system modelling and simulation. As a result, the consistency between the calculated flow and the output flow rate of the calibrated meter was proved, which indicates the effectiveness of the device. The calibration experiments for a flowmeter were carried out under different stroke and speed of fuel pushing. Besides, computational methods of average meter coefficient and repeatability of the calibrated flowmeter were also introduced. According to the testing data, the meter coefficient and the repeatability of the calibrated flowmeter were analysed. The results show that the flow consistency of the calibration device can reach 0.02%, and the deviation between its average meter coefficient and factory inspection data is no more than 0.04%. Besides, pushing speed of its metering cylinder has little influence on the meter coefficient within the effective range of the calibrated meter. This work is ﬁnancially supported by the National Natural Science Foundation of China (grant no. 51575257).