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Simulation research of driving schemes for a dynamic calibration system of fuel turbine flow-meters

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As one of the major parameters of fuel system in aero-engine tests, fuel flow-rate is basically measured by Turbine Flow-Meters (TFM). However, the meter coefficient would inevitably change due to the action of working medium, ambient condition or component wear. Regular calibration of the fuel TFMs must be carried out closely. Calibration can be essentially divided into static calibration and dynamic calibration. Because no dynamic calibration equipment and no corresponding appraisal procedure applicable currently to these flow-meters are used for a long time, confidence level for its dynamic measurement results is greatly affected and the practical demands for dynamic tests of high-maneuver aircrafts cannot be satisfied. In this work, a novel fuel hydraulic circuit is designed, in which a nozzle-flapper valve is adopted to generate a standard flow excitation, and the homologous driving schemes including the torque motor type and the piezoelectric stack type are given as the alternative solutions to drive the high-speed exciting valve. Based on a brief introduction of the calibration system principle, these two above-mentioned driving schemes are mathematically modeled and simulated using AMESim softwae tool, respectively. Simulation results show that dynamic calibration system driven by piezoelectric-stack provides a faster and larger excitation flow than by the torque motor. In the meantime, the piezoelectric-stack driving scheme can ensure the reliable anti-Electromagnetic Interference (EMI) and control the flapper flutter more effectively.

Biography

Wang Bin is a Lecturer at Jiangsu Province Key Laboratory of Aerospace Power System, College of Energy and Power Engineering, Nanjing University of Aeronautics and Astronautics in China. He has been a Master Tutor since 2010. He received his Doctorate's degree from Zhejiang University in 2009 and his research area was hydraulic pumps. His Postdoctoral research was done at the Post-Doctoral Research Station of Aerospace Science and Technology during 2009-2012. Now, his research interests are design and test of aviation hydraulic systems and components, especially aerospace auxiliaries like fuel pumps in aero-engines.

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