a mass adaptive control of an airborne inertial stabilized platform using magnetic bearings

Zhi-zhou Zhang[1], Kun Liu[1], Yu-shu Feng[1]

[1] College of Aerospace Science and Engineering, National University of Defense Technology, People's Republic of China

In order to realize the good imaging quality with the high resolution for the earth observation system, it is necessary to further improve the stability accuracy of the inertial stabilized platform. Because of the low vibration, non-friction and high force per mass capability of magnetic bearings, inertial stabilization platform based on magnetic bearings has attracted extensive attention of researchers in recent years. For different mass camera loads, the inertial stabilization platform using magnetic bearings should have good stability. When the quality of the camera changes, the control parameters of the magnetic bearing system should be adjusted, otherwise the stability of the system will deteriorate. In this paper, a mass adaptive control method is presented for aeronautical inertial stabilization platform using magnetic bearings. Firstly, according to the fixed gap control strategy, if the load quality changes, the suspension gap of the new equilibrium will remain the same, while the suspension current changes. Secondly, a smoothing filter algorithm is designed to extract the steady-state current of the new equilibrium point. Then, according to the steady current of the equilibrium point, a mass-adaptive control algorithm is proposed， whose controller parameters can be adjusted automatically in real-time. Simulation and experimental results show that the above mass adaptive control algorithm can effectively adapt to changes of load mass and achieve better stability of suspension performance.

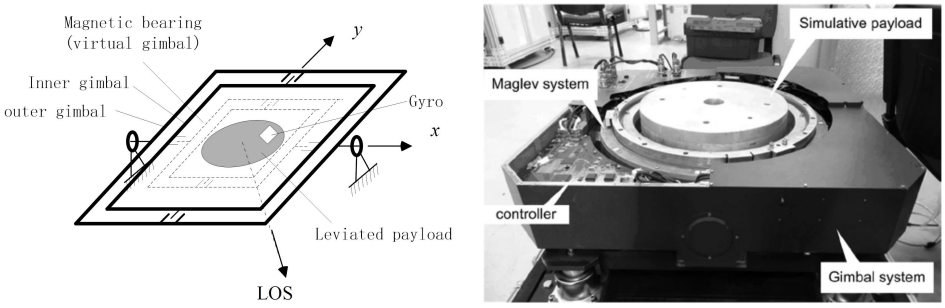

Figure 1. Left to right: Schematic diagram and prototype of inertial stabilization platform

[1] Ji Ming, Electro-Optical Two-Stage Stabilization System Control Technique of Channel Blending. Acta Armamentarii, 21(4), 318-321(2000).
[2] Peter J. Kennedy and R.L. Kennedy, Direct Versus Indirect Line of Sight(LOS) Stabilization. IEEE Transactions on Control Systems Technology, 11(1), 3-15 (2003).
[3] Trumper, D.L., S.M. Olson, and P.K. Subrahmanyan, Linearizing Control of Magnetic Suspension Systems. IEEE Transactions on Control Systems Technology, 5(4), 427-438(1997).
[4] Hilkert, J.M. A Reduced-Order Disturbance Observer Applied to Inertially Stabilized Line-of-Sight Control. Acquisition, Tracking, Pointing, and Laser Systems Technologies XXV. (2011).