Feedback control of flow-induced vibrations on head gimbals assembly inside hard disk drives

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Abstract. High speed flows in working hard disk drives (HDDs) can induce off-track vibrations on a head gimbals assembly (HGA), which limit positioning accuracy of the slider magnetic head on the tip of the HGA for high magnetic storage density in disks. This paper presents experimental studies and numerical simulations on the flow-induced vibrations (FIV) of the HGA inside an HDD and active control of such vibrations. Firstly, the HGA off-track vibration and the airflow pressure fluctuations around the HGA are measured to characterize the FIV of the HGA. Secondly, we propose an active control strategy for such FIV of the HGA, in which feedback acoustic pressures are employed to suppress pressure fluctuations in turbulence around the HGA. Numerical simulations have been carried out on this issue by introducing virtual sensors into the close regions around the HGA. Finally, by using the FIV on the HGA as feedback error signals through the laser Doppler vibrometer, the feedback control of FIV on the HGA has also been demonstrated.

Keywords: active control, flow-induced vibration, acoustic pressure, hard disk drive, head gimbals assembly

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