Sensors and Materials, Vol. 23, No. 2 (2011) 121–133
MYU Tokyo

S & M 0832

In-Phase Coupling Forces Induced by Air Flow and Drive Force in Split-Mode Silicon Micromachined Linear Vibratory Gyroscopes

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(Received March 1, 2010; accepted June 17, 2010)

Key words: coupling forces, air damping, vacuum package, vibratory microgyroscopes

In this paper, we report on the sources, variations and identification of in-phase coupling forces induced by air flow and drive force in split-mode silicon micromachined linear vibratory gyroscopes. Air damping coupling force and drive coupling force are two main components of in-phase coupling forces, derived from air flow and fabrication imperfections, respectively. The expression of in-phase coupling forces induced by these two factors is given and their existence is demonstrated by a novel coupling identification method. Experimental data indicate that air damping coupling is the dominant coupling force in in-phase coupling. The sensitivity of in-phase coupling to vacuum will be a theoretical instruction to packaging requirements and 1 Torr is an optimum vacuum not requiring complex packaging technology, but restraining in-phase coupling forces effectively.

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