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Micro-machined Pendulum and Non-driven Micro-machined Gyroscope

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Abstract

The paper reported a new type of micro-machined pendulum which had gyroscopic effect when installed in rotating carrier. It was demonstrated that a micro-machined pendulum installed in rotating carrier, using the spinning of rotating carrier instead of traditional gyroscope's driving force produced by its structure form a non-driven micro-machined gyroscope. The new micro-machined gyroscope can output pitching, yawing and rolling angular velocity of the rotating carrier, which is equivalent to three traditional gyroscopes.

Keywords: micro-machined pendulum, angular velocity, rotating carrier, gyroscope, attitude;

1. Introduction

The rapid development of rotating carrier makes its attitude sensitive technology in focus, however, there is no international and domestic report on gyroscopes which can meet the requirements of rotating carrier. The paper developed a new type of micro-machined pendulum and its working principle of the detection of pitching, yawing and rolling angular velocity when installed in rotating carrier[1-2]. The micro-machined pendulum that installed in rotating carrier had the functions of three traditional gyroscopes[3-8].

2. Micro-machined pendulum

A front view of impact resistant micro-machined pendulum chip as shown in Fig.1(a), Fig.1(b) was its

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signal detection circuit and Fig.2 showed the sectional drawing of the micro-machined pendulum chip structure.

Pendulous reed suspended on the frame by cantilever beam, set a pair of end bushing symmetrically on the up and bottom of silicon pendulous reed. When rotating carrier was in pitch or yaw motion, the pendulous reed swung with the twist of beam which caused the capacitance change in signal detection circuit, and the unbalance bridge output attitude signal. Discomposing the output signal, the pitching, yawing and rolling angular velocity can be obtained.

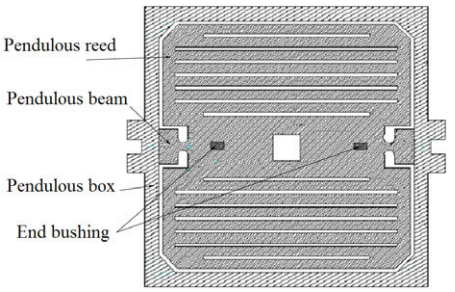

Fig. 1. (a) Micro-machined pendulum chip

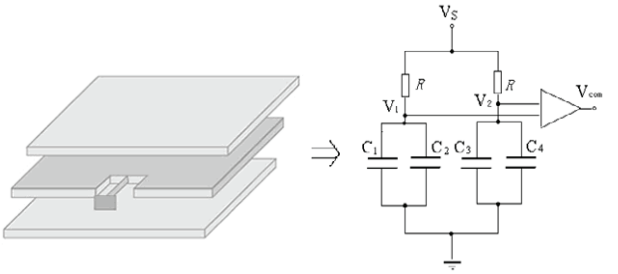

Fig.1.(b) Signal detection circuit

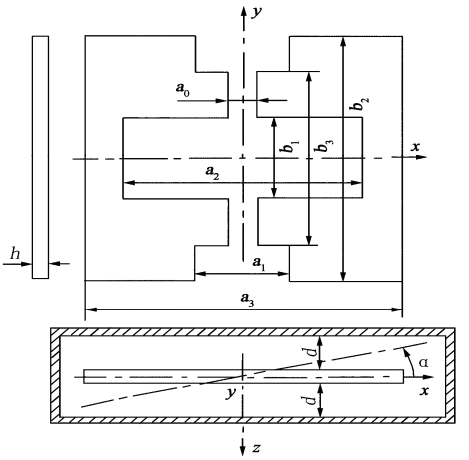

Fig. 2. The sectional drawing of the MEMS chip

3. Principle of micro-machined pendulum in the application of rotating carrier attitude detection

The principle of the detection of pitching, yawing and rolling angular velocity when micro-machined pendulum was installed in rotating carrier was shown in Fig.3. The micro-machined pendulum that installed in rotating carrier constituted a closed loop circuit system, and its principle was shown in Fig.4.