

# A More Reliable and Easy Manufacturing Wireless Thermal Convection Angular Accelerometer without any Movable Parts and Grooved Cavity

林君明, 羅文辰, 林政宏

Communication Engineering

Engineering

jmlin@chu.edu.tw

## Abstract

Five novel ideas are proposed in this paper to integrate an active RFID tag with a thermal convection angular accelerometer on a flexible substrate, thus the device is a wireless sensor. The first innovative idea is that this device is made directly on a flexible substrate without any movable parts and grooved cavity, so it is very easy to make and reliable. The second new idea is that the flexible substrate is plastic or polyimide, the thermal conductivity of the flexible substrate is much lower than the traditional silicon, and thus it can save more power and very useful for mobile operation. The third new idea is that the inert xenon gas is filled in the chamber to conduct the heat instead of CO<sub>2</sub> used in the traditional thermal convection accelerometer. Carbon dioxide can produce oxidation effect to the heater and thermal sensors, while the Xe gas will not. The fourth new idea is to apply a hemi-spherical chamber; it is more streamline in nature with less drag effect. Thus it can ease the fluid flow and yield quicker response. The fifth new idea is the most powerful one to integrate the angular accelerometer with an active RFID tag on the same flexible substrate, thus the device becomes a more useful wireless angular acceleration sensor. In this paper we only use the hemi-spherical chamber filled with Xe gas. The sensitivity is 258°C/(rad/s<sup>2</sup>) and the response time is 81 μs.

Keyword : Angular accelerometer, RFID tag, flexible substrate, grooved cavity, thermal convection, hemi-spherical chamber, xenon gas.