

# MODULE FOR DETECTING A VEHICLE CRASH AND AN AIRBAG DEPLOYING SYSTEM INCLUDING THE SAME

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## ABSTRACT

This paper relates to an invention of a sensor module for detecting a vehicle crash. The module allows detecting occurrence of a vehicle crash in real time by sequentially measuring a stress wave that propagates through a vehicular frame member on set of such a crash. The performance of the module was verified by a crash simulation.

## I. INTRODUCTION

Generally, an airbag deploying system for a vehicle is configured such that inflators for generating gas are operated based on signals generated from crash sensors for detecting a vehicle crash in order to deploy airbags.

Three types of crash sensors have been generally used in such an airbag deploying system: the first is an electro-mechanical crash sensor; the second is an electronic crash sensor; and the last is a mechanical crash sensor. The electro-mechanical crash sensor has been commonly used for the airbag system since its cost is relatively low. However, the electro-mechanical sensor hardly detects a high speed crash in real time.

In the general case, it takes 10~20 msec to detect the car crash by the electric-mechanical crash sensor such as a ball-in-tube sensor. However, it is suggested for passenger safety that the recommended time to fire for a airbag deployment is about 10 msec for the high speed car crash case. Consequently, it needs to reduce the time required for detecting a crash so as to deploy the airbag in a timely manner.

## II. RESULTS

Fig. 1 shows a partial cutaway perspective view of a module and a module mounted to the front-side member frame for detecting a vehicle crash. The module consists of two-rod members,

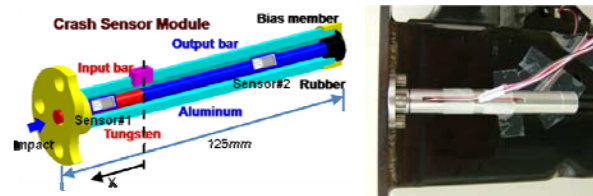


Fig. 1. A module for detecting a vehicle crash

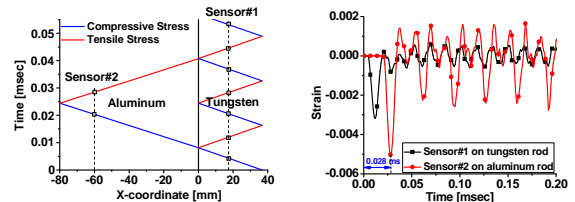


Fig. 2.  $x-t$  diagram and simulation result

the stress wave detecting sensors and a housing. The two rod members are made from metallic materials of tungsten and aluminum with a predetermined length and are oriented parallel to the path of the stress wave caused by a vehicle crash, which propagates through a frame member of a vehicle. Two strain gages are attached on the rod members to detect the stress wave.

A numerical simulation was carried out to verify the performance of the module(see Fig. 2). The  $x-t$  diagram and simulation result show that the stress wave due to the crash is clearly measured as a sinusoidal signal in 0.028 msec, and the total elapsed time is 5 msec. The elapsed time required for detecting a crash is remarkably reduced compared to other crash sensors.

## III. CONCLUSIONS

A new sensor module for detecting a vehicle crash was developed and its performance was verified by the simulation. The module detects a crash very promptly and clearly comparing to other crash sensor.