

# Development of PZT based Impact Detection System for Subsea-Tree Structures

## Research Themes

Structural impact events, such as impact events on structures by foreign object debris always endanger the integrity of the structures and lead to serious consequences, which highlight the structural health monitoring with the capability of detection and location of the impact events in a rapid pace. An innovative algorithm and investigated the sensing model of piezoelectric ceramic sensors was developed to estimate the propagation distances of versatile ultrasonic guided waves, thus both detect and locate the impulse events for various structures.

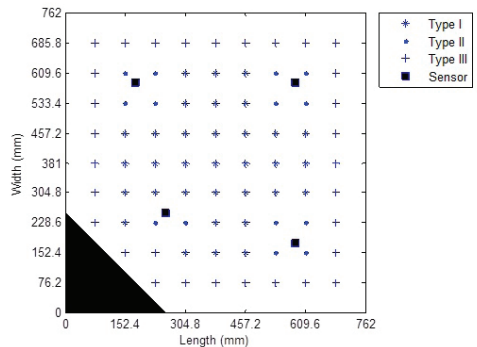
## Recent Accomplishments

The experimental results for location detection can be divided into 3 types:

- In type I, test points were located with high accuracy and high precision, and the errors were less than 20 mm. The test points in type I were relatively far from the sensors and the edges, thus reducing the sources of error.
- In type II, test points were located accurately, with the exception of a few outliers, and the errors were less than 50 mm. Since the test points in type II were closed to one of the sensors, large measurement error was introduced to the signal of the closest sensor.
- In type III, test points were located with low accuracy and low precision. Since they were only 76.2 mm away from one of the edges, the signals received introduced confusion due to the mixture of signals from reflections of the edges and the steel frame.

## Issues

- In type II, to overcome the disadvantage, one possible solution is to ignore the signal of the closest sensor and develop a new algorithm for pattern recognition to estimate the impact location of test points in type II.
- In type III, one future work of the research in this dissertation is to define the boundary between type I and type III, which needs further investigation on the reflection of the Lamb wave from the edges and the steel frame.



**Junxiao Zhu**

Major/Field of Study: Mechanical Engineering

College: Cullen College of Engineering

Professor: Dr. Gangbing Song

Email: jzhu10@uh.edu

ME