



TECHNOLOGY

Data Communication Through Pipes and Structures By Dispersive Elastic Waves

OVERVIEW

Background

Embedded sensors in large civil structures for structural health monitoring applications require data communication capabilities between sensor nodes. Conventional communication modalities include electromagnetic waves or acoustical waves. However, ultrasonic guided elastic waves that can propagate on solid structures such as pipes for a great distance have rarely been studied for data communication purposes because the multi-modal and dispersive characteristics of guided waves make it difficult to interpret the channel responses and to transfer useful information along pipes. Time reversal is an adaptive transmission method that can improve the spatial and temporal wave focusing in highly dispersive or scattering environments.

Innovative Technology

Based on the focusing effect of time reversal, University of Maryland and Carnegie Mellon University researchers have developed a data communication technique using guided waves in a highly dispersive pipe environment. By using this technique, health status data of a structure can be transmitted through the structure itself, eliminating the need for additional communication links such as cables or wireless transmission equipment. This technique is immediately applicable to structures where traditional data communications methods are costly or cumbersome to install and maintain, such as underwater and underground pipes, platforms, and other structures.

Advantages:

- Data transmission using existing structure
- Eliminates need for wired/wireless transmission hardware
- Requires less maintenance than traditional methods

Applications:

- Underwater structures such as pipes, oil platforms, and offshore wind farms
- Underground structures such as pipelines, drill bores, and subways
- Remote monitoring where separate data communication hardware represents significant capital and operating costs

Status: Patent Pending

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Additional Information

INSTITUTION

University of Maryland, College Park

PATENT STATUS

Patent(s) pending

LICENSE STATUS

Available for exclusive or non-exclusive license

CATEGORIES

- Sensors/Monitors

EXTERNAL RESOURCES

- [US Patent 9,413,571](#)

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