



TECHNOLOGY

The Chaotic Time-Reversal Sensor

OVERVIEW

Researchers at the University of Maryland - College Park have developed an altogether new sensor paradigm - The Chaotic Time-Reversal Sensor (CTRS). The CTRS utilizes ideas from the fields of wave chaos and time reversed acoustics to create a new type of sensor concept. Wave chaotic systems are characterized by the extreme sensitivity of wave properties (e.g. impedance, wave amplitude, modal spectrum, etc.) to small perturbations. Time-reversal is a basic symmetry of essentially all wave equations, at least to good approximation for small dissipation. By exploiting this symmetry and combining it with ray chaos, the inventors have proposed a new type of sensor that can operate with a number of important advantages:

1. When in operation it is very sensitive to everything inside and on the boundaries of an enclosure with roughly equal degree of sensitivity everywhere.
2. When in operation the sensor will distribute energy in a fairly homogenous manner about the enclosure, making it difficult to detect by an intruder.
3. It will be difficult for an intruder to mask their appearance or motion inside the enclosure because the signal required to spoof the sensor is extremely complex to create.

Recent work in the field of 'wave chaos' (also called 'quantum chaos') shows that when waves of short wavelength compared to system size scatter within a complex enclosure (e.g., a room, stairwell, etc.), the results are extremely sensitive to small changes in the environment. Most enclosed volumes of interest are likely to be ray-chaotic. This extreme sensitivity suggests that this effect can be exploited for sensing applications.

Sensors can be implemented with ultrasonic sound waves or electromagnetic waves. Waves of different frequencies can be used to fully characterize any change or perturbation caused by an intruder. Refinements of the concept will allow us to locate the intruder, and to direct wave energy to precisely that location, with a minimum of disturbance elsewhere.

For additional information, please contact the Office of Technology Commercialization, University of Maryland College Park, via phone at (301) 405 -3947 or E-mail at otc@umd.edu.

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Additional Information

INSTITUTION

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PATENT STATUS

Patent(s) pending

LICENSE STATUS

Contact OTC for licensing information

CATEGORIES

- Sensors/Monitors

EXTERNAL RESOURCES

PS-2007-053