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Reconfigurable Embedded Sensory System for Continuous Structural Examination (RESCUE)

Embedded structural sensors give real-time stress feedback and early failure warnings.

At any time, components of a building or piece of public infrastructure could fail due to unpredictable mechanical wear and stress, potentially creating dangerous and costly situations for people and businesses. Continuous monitoring systems are a modern innovation that allows responsible parties to have greater insight into the structural integrity or health of the structures under their care, providing information that may be impossible to discern through human observation alone or obtained through non-destructive testing (NDT). However, existing systems tend to be bulky and mounted on the exterior of the structures they monitor, leaving the sensors exposed to damaging environmental conditions that cause them to become unreliable and need to be replaced more quickly.

Researchers at Purdue University have developed a new type of sensor, called RESCUE (Reconfigurable Embedded Sensory System for Continuous Structural Examination), that embeds directly into the material of the structure. This sensor provides real-time feedback on the stress currently wearing on a structure, giving advance warning before a failure can ever occur. By virtue of being placed within the structure itself, RESCUE will also require less maintenance, experience less environmental degradation, and therefore remain reliable longer than traditional monitoring systems.

Technology Validation:

Component parts have been thoroughly tested and validated, including the proposed fractal design-based structure fabrication through additive manufacturing and CMOS technology. This design has then been tested and their mechanics and optimization have been reported. These preliminary tests provide support for the eventual design and manufacture of the fully realized technology.

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Category
Chemicals & Advanced Materials/Materials Processing & Manufacturing Technologies

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Advantages:

-Provides continuous, real-time feedback on the stress being exerted on a given structure

-Gives advance warning before any structural failures can occur

-Provides insight to structural maintenance needs

-Provides insights into the health or structural integrity of any piece of a building or public infrastructure

-Protects people and businesses from the physical and financial harm of potential failures

-Experiences less wear and requires less maintenance than other sensors due to its ability to be embedded within the structure itself

-Smaller design makes it more discrete and easier to place in a variety of areas

-Can be placed within additively manufactured materials

Applications:

-Public infrastructure monitoring

-Private construction and building maintenance

TRL: 4

Intellectual Property:

Provisional-Patent, 2024-05-23, United States

Utility Patent, 2025-05-21, United States

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