New sensors capable of measuring damage to infrastructure

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(PhysOrg.com) -- Dr. Genda Chen, professor of civil, architectural and environmental engineering at Missouri University of Science and Technology, was recently awarded a patent for "Strain Sensitive Coax Cable Sensors for Monitoring Structures."

The patent applies to a new sensor system that has been developed to measure damage to structures, including bridges and buildings. Commonly, structures have been monitored using discrete sensors, where data is taken at a single point.

"For a large-scale infrastructure, it takes a significant number of discrete sensors to understand its overall behavior," Chen says.

Chen and his associates overcome this problem using a coaxial cable sensor, which is capable of monitoring damage along a length of up to 100 feet. A pulse is sent through the cable; if it encounters a disturbance, a reflected wave is sent back to a receiver. The magnitude and travel time of the wave can be used to determine the size and location of a crack in the structure. The distributed sensors have high sensitivity, spatial resolution and speed in their measurements; but they don't require a lot of space within structures.

The newly patented sensors are very reliable and are rugged enough to survive in harsh environments. "This is especially critical for post-earthquake evacuation and recovery, since earthquakes are infrequent events," Chen says.

After several years of no activity, a typical system might malfunction. The distributed sensors have a memory feature that allows them to report severe damage after an earthquake, even if they are temporarily disabled during the actual event.

The new sensors are capable of directly reporting data that engineers can use for structural assessment. Information about the integrity of the structure can be distributed to emergency response personnel in a timely manner. This increases the safety of the response team and allows them to act more effectively.

"I hope engineers are able to integrate structural monitoring technologies into their design and maintenance of infrastructure," Chen says. "It is a cost-effective way to monitor structures over their life span."

Currently, two of the new sensors have been installed on a highway bridge in Missouri. In the future, Chen and his team plan to conduct more field tests on bridges and buildings to demonstrate the new technology and train engineers.

Also named on the patent are Dr. James L. Drewniak, Curators' Professor of electrical and computer engineering; Huimin Mu, of Milpitas, Calif.; and Dr. David Pommerenke, associate professor of electrical and computer engineering at S&T.

Provided by Missouri University