PRESS RELEASE

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Not just the Internet: Foresight uses fibre optics to detect structural damage after earthquakes

Milan, 27 March 2025 – A new method based on optical interferometry, to monitor structural damage to buildings hit by earthquakes in real time. This is the outcome of the **Foresight research project,** led by the **Politecnico di Milano** and carried out together with **INRiM** – the National Metrology Institute of Italy and **INGV** – the National Institute of Geophysics and Volcanology.

The researchers want to **exploit the fibre optic systems** already in homes to provide an Internet connection, **and use them to check the condition of buildings after an earthquake** – especially in the period immediately following the first shocks.

By employing interferometry techniques, the multidisciplinary team uses fibre-optic signals to gather information, which can be done both promptly and on a large scale. **By converting fibre-optic signals into predictive data relative to the structures, researchers are able to forecast the extent of potential damage even before any visible signs appear**, providing vital clues for emergency response teams.

Simulations by the researchers showed that the method has the potential to detect damage during the initial and most critical phase, after which it is crucial to check the state of the homes very quickly, because people displaced due to earthquakes need a safe place to shelter.

The innovative **Foresight** system offers an efficient and cost-effective solution, establishing **a framework for rapid post-earthquake risk assessment** that is 90% faster than current methods, up to 50% **cheaper**, **fully scalable, and more reliable** than traditional methods of visual appraisal.

Alper Kanyilmaz, Foresight project supervisor and associate professor in the Department of Architecture, Built Environment and Construction Engineering at the Politecnico di Milano, explained the idea behind the project: "*We aim to create a system that can rapidly assess the structural safety of buildings after an earthquake, without the need for any additional infrastructure. Our end goal is to provide communities with the tools they need in order to respond more quickly and safely to seismic events."*

Hasan Ceylan, a researcher at the Politecnico di Milano, explained his role: *"I'm using advanced techniques in the Foresight project, including mathematical models and data analysis, to assess the stability and safety of buildings, and combining these with optical interferometry. In this way, we can offer a practical application, creating resilience in the event of real earthquakes in our cities*." Hasan is the recipient of a grant from Marie Skłodowska-Curie Actions, a prestigious European research funding programme.

Measuring the signals inside the cables plays a very important part. **Simone Donadello**, a researcher at INRiM and member of the Foresight team, gave more details: *"Optical interferometry, which is derived from the advanced measurement techniques developed at INRiM, allows us to exploit the optical fibres that carry existing data for use as extra sensitive sensors. This method makes it possible to detect minimal structural changes, and use them to provide reliable information about the amount of damage."*

André Herrero, a researcher at INGV, also added: "*Today's fibre sensing techniques are providing new ways of monitoring natural events and their impact on our urban fabric. This extra tool can be used to monitor structures in a direct, continuous way, providing an important means of information and security for society*."

The joint research group of the Politecnico di Milano and INRiM, together with INGV and Open Fiber, have filed a patent application for the Foresight method. The next phase of the research will focus on the applications of the system and on real tests in urban areas, to enable this technology to play a important part in earthquake preparedness and disaster response. Further developments could see fibre optic networks become part of a wider strategy for monitoring the structural health of buildings in the event of earthquakes.

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