i-MON

Future Sensor Techniques for in-situ Structural Health Monitoring of Concrete Structures

Programm / Ausschreibung	COIN, Aufbau, COIN Aufbau 8. Ausschreibung	**Status**	laufend
Projektstart	01.06.2021	**Projektende**	31.05.2026
Zeitraum	2021 - 2026	**Projektlaufzeit**	60 Monate
Keywords	Structural Health Monitoring, load-bearing concrete structures, integrated sensors, Surface Acoustic Wave Sensors, RFID Tags		

Projektbeschreibung

The collapse of the Morandi Bridge in Genoa in August 2018 has highlighted major shortcomings in the monitoring of the Structural Health of bridges in Italy. This problem concerns, in fact, many large civil engineering structures (bridges, buildings, tunnels, dams), whose evolution must be monitored on a regular basis over long periods of time (> 50-100 yrs). It is particularly important to monitor long-term changes in the state of stress (compression or tension) at different points of load-bearing structures, due to the inhomogeneity, anisotropy, cracking behavior and long-term properties (creep and shrinkage) of reinforced concrete. Several solutions exist. They are essentially based on: 1. installation of surface strain gauges, 2. following of reference points or patterns using optical tools (incl. HD Cameras), 3. use of embedded optical fibres. These solutions are not ideal. External sensors and reference patterns simply do not allow the direct capture of stress fields inside the structure. In the case of reference patterns, the measurement must also be perfectly reproducible, to follow tiny changes. This poses major calibration problems in outdoor environment (rain, wind, temperature gradients, etc.). The integration of optical fibers in concrete poses, for its part, installation, ageing and cost problems. The long-term objective of i-MON is to develop a scientific and technical know-how in the field of in-situ measurement of stress and strain fields in medium and large concrete structures (bridges, buildings and tunnels). The innovative solutions developed in the frame of the project will compensate for the shortcomings of the existing monitoring solutions. They will enable the measurement of deformation fields inside concrete elements, from a few cm up to 20-30cm below the surface, at various critical points of the structure, over its lifetime. Combined measurements will then make it possible to monitor the evolution of the structure, as a whole. The use of integrated sensors that can be wirelessly interrogated from the outside is obviously one of the most promising options for carrying out these measurements. Research will therefore focus, in particular, on the development of dedicated Surface Acoustic Wave sensors, for strain monitoring. These MEMS sensors are extremely robust over long periods, are completely passive and wireless (no embedded electronics), they can be identified (RF-TAGs), which offers very interesting prospects (i-concrete, intelligent maintenance and traceability, augmented reality, digitization and industry4.0-related applications). The main technical innovations of the i-MON will concern the sensors themselves, their housings and coupling to the surrounding concrete structure, the reader, and data processing algorithm. Researchers will validate the proper operation of the technology in laboratory conditions, first. Together with industrial partners, they will then test it on site in real conditions.

Projektpartner

- FH Kärnten - gemeinnützige Gesellschaft mbH