

A Sensor network Targeted On Novel IdentifiCation of cracks

University of Bologna - PhD Programme

SEHM²: Structural and Environmental Health Monitoring and Management

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SHM refers to monitoring systems that have some capability to automatically acquire and process data to assess structural health including damage detection and structural prognostics.



VIBRATIONAL ANALYSIS



Forced oscillations of a cantilever beam. Vibrational analysis through accelerometers and tilt sensors

Research Fellow



Bachelor Students



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Research interests

• Actuator & Sensors : Analog Design, Embedded Systems, Firmware development

Our system integrates an innovative low weight sensor network with advanced structural models and exploits an intuitive graphical interface to support applications for real-time data analysis and long-term maintenance strategies of heterogeneous structures. Thanks to the user-friendly graphical interface the system can support technicians and control staff to assess the structural integrity of the monitored structures.

Modal Analysis is the study of the dynamic properties of systems in the frequency domain. Natural frequencies of vibration and displacement mode shapes fully characterize the vibrational behaviour of a structure.



Principal natural frecquencies estimation

Signal Processing Techniques are applied to acquired signals in order to perform **Spectral Analysis** and

• Non Nestructive **Evaluation: methods** and technologies: Guided Ultrasonic Waves Inspection, Acoustic Emissions Testing, Impedance, Strain

• Software Architecture:

Semantic technologies, Web of things system software engineering and software dependability Machine Learning, Computer Vision, Domain specific languages, Fog Computing, Data Fusion, Cyber-Physical Systems, Processing, Signal Spectral Analysis, Modal Analysis

These technologies increment safety, which stems from the possibility of detecting and localizing defects and estimate their severity at an early stage in a completely non-invasive manner. Human operational maintenance and inspections costs can be decreased, passing from a regularly scheduled maintenance program to an "on condition" maintenance program. Remote control also enhances the potentiality of the methods proposed, saving time and resources.

HW/SW ARCHITECTURE

The developed circuitry

The gateway sends acquired data to an MQTT broker.

Contacts

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ARCES

consists of 30 x 23 mm small footprint, 4 g lightweight low-power and sensor nodes consuming less than 40 mW in active mode. Up to 64 nodes can be compliant connected to developed SAN had-hoc bus.



Broswer interface

an application can Later subscribe to that information real-time displays and acceleration/tilt values.

Local data processing capabilities are exploited to fuse diffrent types of measurements and producing a **multi-type sensors** platform.

ERCOLE DE CASTRO





DIPARTIMENTO DI INFORMATICA - SCIENZA E INGEGNERIA