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Methodology for Health Monitoring of Reinforced Concrete Structures Subject to Seismic Excitations

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Student Poster

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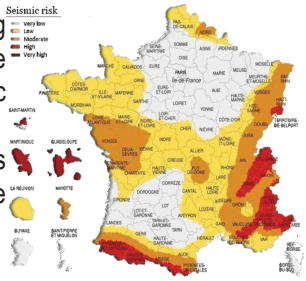
Research Objective

Defining an appropriate methodology for detecting damages of a reinforced concrete structure.

It's a fact that France is a country with moderate seismic activity, but it's also well known that it went through some devastating earthquakes in the past. Therefore, damage structure detection is crucial to ensure citizen safety.

Currently detection methods allowing preventive maintenance or enabling the definition of repair actions after the seismic event, do not exist.

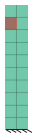
The aim of this work is to detect damages by analyzing the dynamic behaviour of the structure following three steps :



1. Sensor-based instrumentation building
2. Signal processing.
3. Developing an accurate methodology to detect damages.

State of Research

❑ Evaluation of some Vibration-based damage identification methods thanks to numerical model of a concrete beam and a 3-storey building. Damage is introduced as a simple local reduction of the Young's modulus.


Cantilever concrete beam


A 3-storey reinforced-concrete building

- Various methods to assess the damage based on vibration measures have been used and compared such as:
  - Frequency changes
  - Modal assurance criterion (MAC)
  - Mode shape changes
  - Mode shape curvature (MSCM)
  - Curvature damage factor (CDF)
  - Flexibility change

❑ Elaboration of an algorithm by combining some methods in order to detect, locate and quantify accurately the damage.

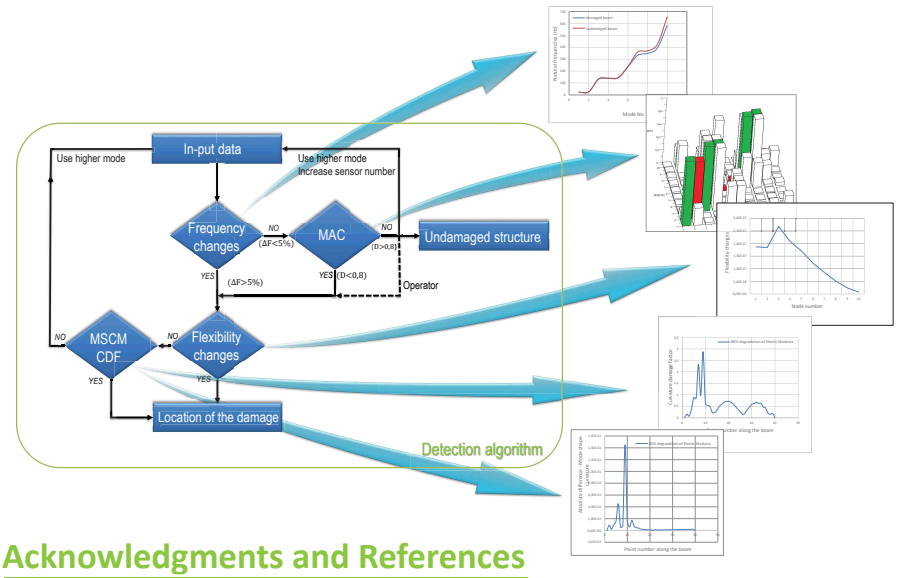
Expected Contributions

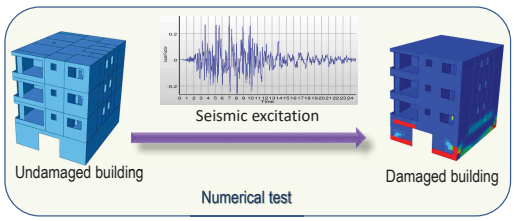
❑ Establishing an accurate methodology of detection and location of structural damages.
❑ Studying sensors capabilities and optimizing their numbers and locations.
❑ Optimizing maintenance cost and reducing the risk of collapse.
❑ Democratization to a large potential users of the instrumentation means.

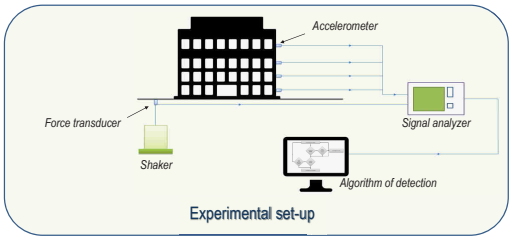
Next Steps

❑ Numerical evaluation of the detection algorithm on a numerical model of a damaged reinforced-concrete-building as a result of a seismic excitation.
❑ Experimental evaluation with a dummy building model realized with 3D printing technology.
❑ Defining signal processing techniques with real sensors.
❑ Experimental evaluation of the detection algorithm.
❑ Extension of the research to other structure types.

Research Details







Acknowledgments and References

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