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# Active and passive infrared thermography applied to the detection and characterization of hidden defects in structure

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Infrared thermography for Non Destructive Testing (NDT) has encountered a wide spreading this last 2 decades, in particular thanks to emergence on the market of low cost uncooled infrared camera. So, infrared thermography is not anymore a measurement technique limited to laboratory application. It has been more and more involved in civil engineering and cultural heritage applications, but also in many other domains, as indicated by numerous papers in the literature.
Nevertheless, laboratory, measurements are done as much as possible in quite ideal conditions (good atmosphere conditions, known properties of materials, etc.), while measurement on real site requires to consider the influence of not controlled environmental parameters and additional unknown thermal properties. So, dedicated protocol and additional sensors are required for measurement data correction.
Furthermore, thermal excitation is required to enhance the signature of defects in materials. Post-processing of data requires to take into account the protocol used for the thermal excitation and sometimes its nature to avoid false detection. This analysis step is based on signal and image processing tool and allows to carry out the detection. Characterization of anomalies detected at the previous step can be done by additional signal processing in particular for manufactured objects. The use of thermal modelling and inverse method allows to determine properties of the defective area.
The present paper will first address a review of some protocols currently in use for field measurement with passive and/or active infrared measurements. Illustrations in various experiments carried out on civil engineering structure will be shown and discussed.
In a second part, different post-processing approaches will be presented and discussed. In particular, a review of the most standard processing methods like Fast Fourier Analysis, Principal Components Analysis, Polynomial Decomposition, defect characterization using direct thermal modelling or inverse thermal modelling will be presented and discussed.
Conclusion and perspectives will be proposed in link with structure monitoring or cultural heritage applications.

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