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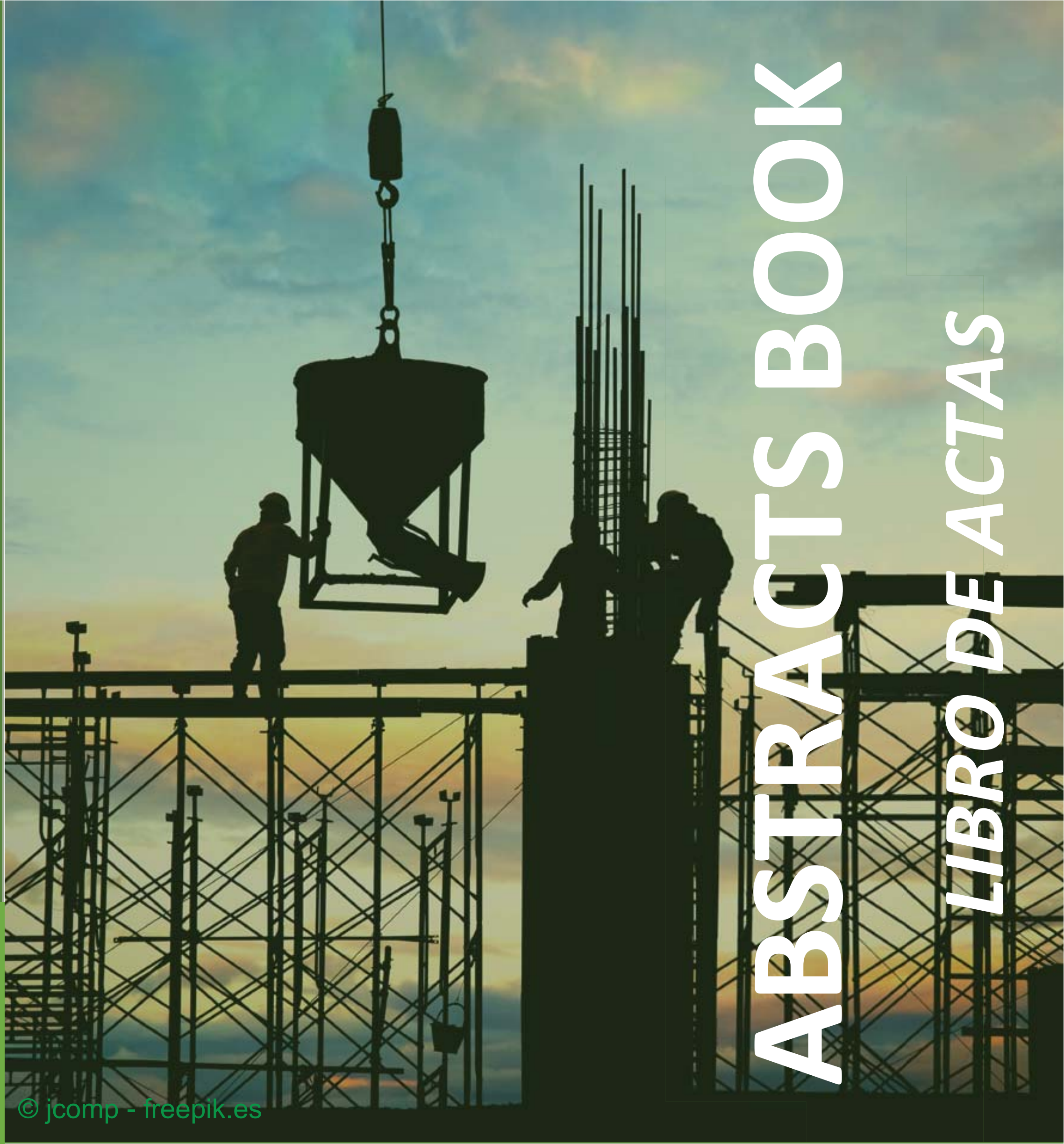

ABSTRACTS BOOK

LIBRO DE ACTAS

VII International conference on Technological Innovation in Building

VII Congreso Internacional de Innovación tecnológica en edificación

VII CONGRESO INTERNACIONAL DE INNOVACIÓN TECNOLÓGICA EN EDIFICACIÓN

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PREVENTIVE CONSERVATION FOR SUSTAINABLE DEVELOPMENT BY NON-DESTRUCTIVE ANALYSIS IN CULTURAL HERITAGE BUILDINGS. THERMOGRAPHIC STUDY IN THE COLUMNS OF THE PATIO DE LOS LEONES DE LA ALHAMBRA, GRANADA (SPAIN)

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Abstract

The exposure of architectural heritage to environmental conditions has a significant impact on its degradation process [1], [2]. For this reason, the demand for non-destructive and non-invasive diagnostic techniques capable of evaluating site is the most effective resource for assessing the state of deterioration and its evolution. Infrared thermography (IRT) is a non-destructive technique that has been widely applied to the investigation of built heritage, providing information on the surface structure by analyzing the process of heat diffusion within the measured element, in which the changes of temperature are analyzed. This experience involves the evaluation of surface thermal patterns: temperature that varies in space and time can reveal discontinuities below the surface, cracks or other types of defects confirming [3] which types of states are in the region near the surface of an element.

This research has focused on the analysis of the thermographic study done on the marble columns of the Courtyard of the Lions in the Alhambra in Granada (Spain), an emblematic monumental complex of the Nasrid reign and named Cultural Heritage of Humanity by UNESCO since the year 1984. In this study, passive infrared thermography was applied to improve the knowledge of the evolution of the state of conservation and deterioration which will allow establishing predictive models of behaviour as part of the activities carried out in the European WARMEST project (loW Altitude Remote sensing for the Monitoring of the state of Cultural hEritage Sites: building an inTegrated model for maintenance). This will allow establishing predictive models of behaviour, keys for the sustainable preventive conservation of heritage, a critical challenge for cultural heritage to contribute, as a tourist attraction, to growth socio-economic and social of our cities.

The state of deterioration of the same and the knowledge of its conditions in previous periods has allowed us to determine the differences to which the surfaces of the elements are currently exposed. As a result, it has been possible to verify that the differences in temperature on the surface of the columns respond to changes in sunstroke and direction of sunlight and also is very important to consider the state of the same because these causes a transfer of different thermal in the material. In figure 1 it can be seen the differences between the two moments in which the thermographic measurements were done.

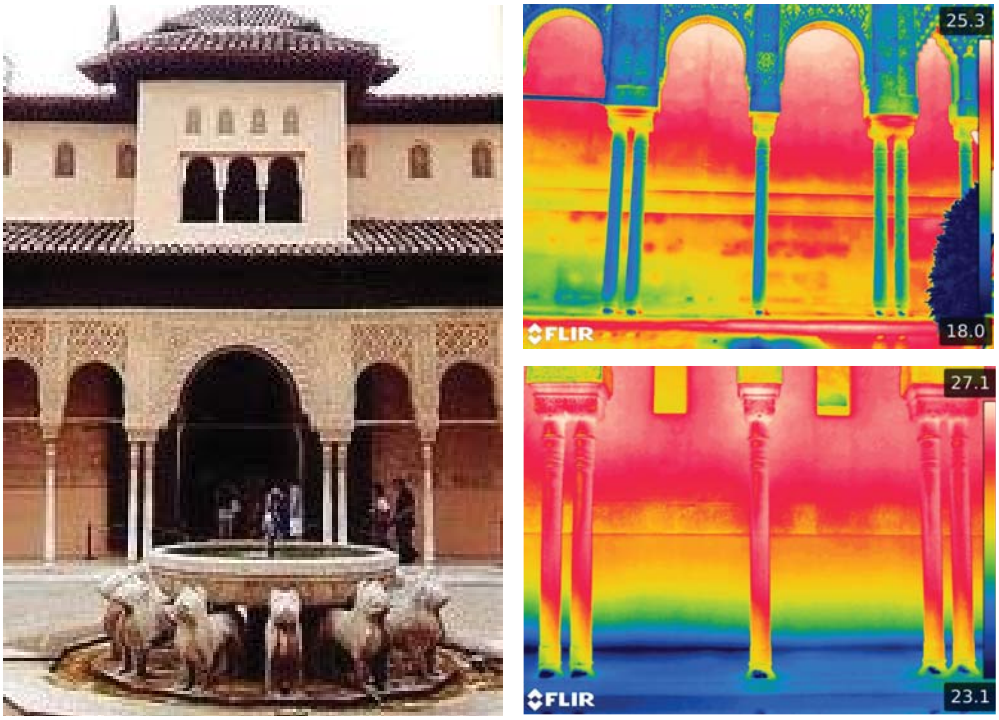

Figure 1: *General view of Courtyard of the Lions in the Alhambra in Granada (Spain) and images of thermographic measurements. (Source: Mª Paz Sáez-Pérez)*

The information and results allow to development of a Decision Support System for the management and maintenance of heritage sites. This system, which should lead to the creation of the Cultural Heritage Risk Analysis tool - ARPaC (or Cultural Heritage Risk Analysis - CHRA), aims to become a tool capable of suggesting the best option in the maintenance and management of historical and natural heritage spaces. In addition, it is configured as a system of anticipation and prevention of greater damage in the maintenance and management of heritage. In this way, the various actions will make information on underwater cultural heritage accessible for academic, social, tourism and sustainable purposes, which will inevitably generate greater public understanding and the need to protect the sites.

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References

[1] M. P. Sáez-Pérez, J. Rodríguez-Gordillo. The Influence of Solar Radiation on the Deterioration of the Marble Columns in the Courtyard of the Lions in the Alhambra. Studies in Conservation, 53, 3 (2008), 145-157. DOI: 10.2307/27867034

[2] J. Rodríguez-Gordillo, M. P. Sáez-Pérez. Effects of thermal changes on Macael marble: Experimental study. Construction and Building Materials 20 (2006), 355–365. DOI:10.1016/j.conbuildmat.2005.01.061

[3] A. Kylili, P.A. Fokaides P. Christou, S. A. Kalogirou, Infrared thermography (IRT) applications for building diagnostics: A review. Applied Energy 134 (2014), 531–549. DOI: 10.1016/j.apenergy.2014.08.005