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Structural Health Monitoring of the Roman Arena of Verona, Italy

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Ancient structures - especially very old ones - prove their soundness and the correctness of their structural layout by reaching our days in relatively good conditions. This is the case of the Roman Arena in Verona, Italy, likely built in the I century A.D., and still standing in the historical centre of Verona, being the symbol of the city and open to public use for visits but also for operas, concerts and relevant shows.

With a closer look however, it is possible to appraise the damages that the passing of time and the natural or man induced events such as historical earthquakes, floods or wars and sieges left on the structure. The seismic events (the worst recorded in 1116, 1117 and in 1183) induced serious damage on the Arena, being the cause of the almost complete collapse of the third (external) ring of the monument, today only remaining in the so called "wing" of the Arena, an isolated portion of stone blocks curved wall characterized by a repetition of arches and massive pillars.

With the purpose of evaluating the structural response of the Arena to static, dynamic (e.g. shows, concerts) and seismic loads, a Structural Health Monitoring system was installed in the Arena in 2011, with state of the art technology for the data recording in relevant positions of the Arena. A detailed crack pattern survey was carried out in order to locate the main cracks of the structure, or to identify the most suitable positions where to apply the displacement sensors to determine the reversibility of the natural displacements or deformations trends of the monument.

Finite Elements models were employed to define the relevant modal parameters of the Arena: global modes were identified and thus - with a special focus on the wing - acceleration sensors were installed in the areas where significant dynamic amplifications are expected according to the FE modelling approach.

Results of the SHM system will be employed for tuning the available behavioural models (FE, but also Limit Analysis), in order to trace the structural response of the monument for assessing the operational conditions and predicting the safety conditions of the Arena in the eventuality of a major earthquake.

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Ключевые слова:

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References