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DYNAMICS OF ANCIENT MASONRY BUILDINGS BY USING THE NON-SMOOTH CONTACT DYNAMICS METHOD

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The Non-smooth Contact Dynamics Method (NSCD), implemented in the LMGC90 code, has been recently applied to the study of the seismic vulnerability of ancient masonry structures, such as Roman buildings [1] or Romanesque churches [2]. The NSCD Method has revealed a powerful tool for exploring their complex dynamics, since it combines modelling simplicity and great predictive capabilities. The results of the numerical simulations of [1,2] have given a deep insight into the seismic vulnerability of the considered structures, pointing out possible failure mechanisms, and, consequently, suggesting appropriate retrofitting works. According to the NSCD Method, the masonries are modelled as systems of rigid blocks, whose sliding motions are governed by the Signorini's impenetrability condition and by the dry-friction Coulomb's law. Furthermore, impacts between blocks are supposed to be perfectly plastic, and they represent the only source of energy dissipation of the system.

In the present study, the LMGC90 code was used to investigate the dynamics of the roman arches of Burnum, in Croatia, which have been object of an intense archeological investigation in the last years [3]. The primary objectives is to assess the stability of the present two arches against a seismic event, because of their bad conditions of preservation. Simulations are performed by applying harmonic oscillations to the basement where the arches are laid on. Considering different amplitudes and frequencies, the possible collapse mechanisms are investigated. Then a real situation is reproduced by considering the base oscillation of a real seism.
The second purpose of the study is to verify if the collapse of the main arch, originally adjacent to the two actual arches, which occurred in the 17-th century, was due to an earthquake or to a very strong wind ("bora" wind), as hypothesized by historical sources. The main arch has been recreated, according to historical pictures, and simulations are performed, considering both the seismic load and the wind pressure.

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