Numerical modelling of masonry arches strengthened with SFRM

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Abstract. The adoption of effective strengthening techniques of historical constructions is one of the most widely debated aspects in structural engineering. Within this topic, the application of steel fiber reinforced mortar (SFRM) has been recently proposed as a low invasive and effective way to obtain a considerable structural benefit in the safety of existing masonry structure. To this purpose, in this paper the experimental results obtained on a circular masonry arches are presented. The considered specimens, subjected to a vertical increasing static load, is tested in the unstrengthened and strengthened configurations, and is part of a wider experimental campaign. After presenting and discussing the experimental results, they are compared with those relative to numerical simulations conducted by means of a discrete macro-element (DME) strategy, based on a simple mechanical scheme, able to model the nonlinear behavior of masonry structures with a limited computational effort. Such an approach is here extended to model the SFRM strengthening technique accounting for the main failure mechanisms associated to the combined presence existing masonry and the additional strengthening layer applied at the intrados of the arch. Numerical and experimental results demonstrate the efficacy of the proposed retrofitting strategy both in terms of bearing capacity and increase of ductility.