Assessment of Masonry Structures by Means of Linear Programming

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ABSTRACT

Ancient masonry structures are mainly characterized by an anisotropic behaviour and by heterogeneity. Masonry structures materials highlight by their high compression resistance and very low -or even null-tensile strength. Also, it is not easy to ascertain the initial internal tensions and the real boundary conditions. The use of Linear Programming for safety assessment of historic masonry structures was proposed by Kooharian in 1953 [1]. On the other hand, Charnes and Greenberg [2] demonstrated in 1951 the relationship between the solution of a problem of Limit Analysis and the two solutions obtained from Dual Linear Programs. At that moment the theory was well known but it was not implemented until the end of the 1970 decade when Livesley [3] accomplished for the first time a Linear Program in order to solve the problem of the safety assessment of masonry structures. However, those first approximations and most of the subsequent developments could be only suitable for a general structural behaviour, but they were not valid for a universal use.

This article presents new approaches and different extensions of original researches that could be solved by Linear Programming. New approaches are oriented to more complex problems [4] that can be modeled by Non-Smooth Non-Linear Programs whose Computational Complexity is NP-hard, but that can be approximately solved using Sequential Linear Programming. Inside this more complex mechanical behaviour are incorporated different phenomenon as Sliding Collapse and Large Deformations Collapse.

References

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