
Computerized Upper Bound Limit Analysis CUBLA for complex historical masonry structures

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Abstract

The paper discusses the main features of a novel limit analysis software called CUBLA (Computerized Upper Bound Limit Analysis) aimed at the accurate prediction of the ultimate behavior of historical masonry structures exhibiting high geometric complexity. Particular attention is given to the estimation of the seismic vulnerability.

The approach bases on a full 3D discretization of the masonry structure, which allows plastic dissipation exclusively at the interface between contiguous elements. After the derivation of a standard linear programming problem to predict collapse multiplier, active failure mechanism and -from the dual problem- internal stress distribution at failure, an efficient iterative procedure is discussed to simulate the problem in case of interfaces purely frictional.

A series of paradigmatic case studies is reviewed, focusing in particular on building aggregates and churches. A final extension of the approach presented is proposed, which relies in a fast algorithm equipped with a surrogate optimization kernel, to automatically provide that disposition of tie rods that maximizes the load carrying capacity.

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