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On the equilibrium and admissibility coupling in NT vaults of general shape

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Abstract

In the paper a approach for dealing with masonry vault analysis is outlined, based on the selection of membrane stress surfaces obeying equilibrium and masonry material admissibility at the meanwhile. Thereafter the problem is expressed in function of a suitably defined stress function allowing some simplification and the search of the solution is, then, set up by an energetic approach. In general, assuming the stress function as a generic function of the membrane surface, it is demonstrated that, under gravitational loads, the equilibrium of the vault implies its admissibility. This result is very significant since coupling of equilibrium and strength explains why, anciently, it was so easy to build up masonry vaults, by simply hypothesizing a resistant shape under the assigned loads and, at the same time, resulting also in the satisfaction of the material requirements as regards to stress admissibility. A "direct stress" approach is outlined, as well, for obtaining analytical solutions for each vault shape, and, as an example, its application to the case of the barrel vaults is reported. © 2010 Elsevier Ltd. All rights reserved.

Author keywords

Analysis of masonry constructions; Equilibrium; No-tension material; Shells; Stress admissibility; Structural mechanics; Vaults

Indexed keywords

Analytical solutions; Barrel vault; Energetic approach; Equilibrium; Generic functions; Gravitational loads; Masonry vaults; Material requirements; Membrane stress; Membrane surface; No-tension material; Shells; Stress functions; Structural mechanics

Engineering controlled terms: Foundations; Masonry construction; Masonry materials

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Keywords

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