Equilibrium of masonry vaults

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Abstract

So as a masonry arch can be idealized as an inverted chain (the thrust line) a masonry vault can be modeled as a membrane S. If the vault is unilateral the membrane must be compressed at any point and contained between the extrados and intrados surfaces of the vault. The main difference between a chain and a membrane is that the chain is underdetermined and the equilibrium under a given load is assured only if the chain takes the "equilibrium shape". On the other hand a membrane S can equilibrate a wide range of loads over a specified shape. The membrane S becomes underdetermined if is unilateral: "the shape S can be given as long as S is under compression for the given load, but it must adapt to loads in regions over which the stress becomes uniaxial". A number of simple problems of equilibrium concerning typical vaults, domes and helical stairs is solved by adopting a stress function formulation.

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