

## The properties of arches under loading especially for historical buildings

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## Summary

Some ancient Iranian monumental buildings, mosques and other historical structures which had been built in various zones in Iran present the covering structure carried by a system of round arches, built up adopting multiple-leaves masonry technology. Buttresses resist the lateral thrust of the arches. But buttresses can undergo significant displacements such as a strength member of structure. As a consequence, the geometric features of the arches are modified, and many cracks open. The global static conditions of the structure are compromised, especially when there are losses of contact and even local separations between the masonry leaves of the arches, as it can be observed in. This paper presents the results of a numeric modelling of an arch assumed with reference to these structures, the results indicate the progressive loss of bearing capacity due to the buttresses displacement and the worst contact characteristics of the layers. Also some possibilities for future development about using of arches in structures are listed at the end.

**Keywords:** arch, crack, historical buildings, loading, modelling

## 1. Introduction

In the period of revitalization and rehabilitation of the Old Town as the historical nucleus of the city, an exceptional attention was given to emphasize the role of the Old Town as an important international cultural centre in order to bring the revitalization process to the international level. Along with routine reconstruction of various buildings, special attention was devoted to rehabilitation of buildings, listed as monuments of historical heritage. In all countries valuable historical monuments are protected by special laws, while their technical state is checked periodically, and their reliability, strength and resistance to various environmental and human inflicted effects are predicted. For many centuries, up to modern building techniques, in order to cover large spans & girders in constructions, there were two possible solutions: the use of wood beams or wood trusses, and the use of arches and arch shaped structures (barrel-vaults and cross-vaults). As wood is a material subjected to a relatively rapid degrade, and sometimes it is quite expensive & fragile, stone masonry or brick masonry arch structures were the technique preferred for important monumental buildings, as the medieval churches, built up to last in time. In this design method for the arches, they were built following empirical rules concerning the geometric features of the element. In the following times various methods based on equilibrium were developed, until the final formulation of Culmann in thirteenth century. Stone masonry arches have been adopted for important structures also in recent times, till the end of that century they were common for road and railway bridges. Modern structural analysis gave many results about the