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The Reason Why Al-Kashi’s Understanding of Islamic Arches Was Wrong

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Abstract : It is a widely held view that Ghiyath al-Din Jamshid-e-Kashani, also known as al-Kashi (1380-1429 CE), was the first who played a significant role in the interaction between mathematicians and architects by introducing theoretical knowledge in Islamic architecture. In academic discourses, geometric rules extracted from his splendid volume titled as Key of Arithmetic has uncritically believed by historians of architecture to contemplate the whole process of arch design all throughout the Islamic buildings. His theories tried to solve the fundamental problem of structural design and to understand what makes an Islamic structure safe or unsafe. As a result, al-Kashi arrived at the conclusion that a safe state of equilibrium is achieved through a specific geometry as a rule. This paper reassesses the stability of al-Kashi's systematized principal forms to evaluate the logic of his hypothesis with a special focus on large spans. Besides the empirical experiences of the author in masonry constructions, the finite element approach was proposed considering the current standards in order to get a better understanding of the validity of geometric rules proposed by al-Kashi for the equilibrium conditions of Islamic masonry arches and vaults. The state of damage of his reference arches under loading condition confirms beyond any doubt that his conclusion of the geometrical configuration measured through his treaties present some serious operational limits and do not go further than some individualized mathematical hypothesis. Therefore, the nature of his mathematical studies regarding Islamic arches is in complete contradiction with the practical knowledge of construction methodology.

Keywords : Jamshid al-Kashani, Islamic architecture, Islamic geometry, construction equilibrium, collapse mechanism
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