

A Systematic Review of Numerical Seismic Analysis of Traditional Adobe Structures: Modelling Approaches, Bibliometric Analysis, and Keyword Co-occurrence Patterns



Safiye İncinur Gökçe¹, Sedat Kömürcü², Sema Alaçam³
İstanbul Technical University^{1,3}, Universitat Politècnica de
Catalunya & Istanbul Technical University²
[gokce25@itu.edu.tr¹](mailto:gokce25@itu.edu.tr), [komurcus@itu.edu.tr²](mailto:komurcus@itu.edu.tr),
[alacams@itu.edu.tr³](mailto:alacams@itu.edu.tr)

ABSTRACT

This study presents a systematic review of numerical research on the seismic performance of traditional adobe structures, supported by a bibliometric analysis. Publications were retrieved from the Web of Science database, resulting in an initial dataset of 218 records. Following a multi-stage screening process, 49 full-text articles were examined, of which 32 provided extractable data on modelling approaches and evaluation techniques. Bibliometric analysis indicates a significant increase in research activity since 2012, reaching its peak in 2024. Major contributions originate from China, Peru, Portugal, the United States, Italy, and Türkiye, reflecting the geographical relevance of earthen construction practices. Citation patterns further demonstrate the growing recognition of seismic analysis of adobe structures as an emerging and distinct research domain.

The reviewed studies investigate numerical approaches used to evaluate structural response across multiple scales, ranging from wall-level simulations to building-scale analyses and, more recently, urban-scale assessments. The findings reveal a predominant reliance on simplified representations of material behaviour and structural systems, with a strong emphasis on in-plane response. Consequently, out-of-plane mechanisms and coupled loading conditions remain comparatively underexplored, despite their critical role in governing failure mechanisms in adobe structures. Bibliometric and keyword co-occurrence analyses indicate that research is largely concentrated around seismic vulnerability and structural evaluation. However, the relationship between modelling assumptions and actual structural behaviour remains insufficiently addressed. By synthesizing both methodological tendencies and research patterns, this study highlights key limitations in the current body of literature and identifies the need for more integrated and multi-scale approaches that better capture the inherent complexity of adobe structures under seismic loading.

KEY WORDS:

Adobe Structure, seismic analysis, numeric modelling, bibliometric analysis, keyword co-occurrence