

Scopus - Document details

Document details

Back to results | < Previous 23 of 60 Next >

International Journal of Mechanics  
Volume 7, Issue 3, 2013, Pages 172-179

**Preservation provisions for the environmental protection of egyptian monuments subject to structural vibrations** (Article)

Corbi, O.<sup>a</sup>, Zaghw, A.H.<sup>b</sup>, Elattar, A.<sup>b</sup>, Saleh, A.<sup>b</sup>

<sup>a</sup> Department of Structural Engineering and Architecture, University of Naples Federico II, Napoli, Italy  
<sup>b</sup> Department of Structural Engineering, University of Cairo, Giza, Egypt

**Abstract**

The Egyptian area is characterized by a number of outstanding historical minarets, which represent a significant part of the monumental and architectural heritage of the country. Such structures usually are rather vulnerable as regards to environmental vibrations due to earthquakes, strong winds or even traffic vibrations, and proper protection strategies are required. In the paper some possible control devices are considered based on passive or semi-active control strategies, also making recourse to the adoption of smart materials.

**Author keywords**

Control devices; Dynamic structural control; Egypt; Environmental vibrations; Historical constructions; Shape memory alloys

ISSN: 19984448 Source Type: Journal Original language: English Document Type: Article

Cited by 11 documents

- Stability of evolutionary brittle-tension 2D solids with heterogeneous resistance  
Eusebi, A., Corbi, O.  
(2016) *Computers and Structures*
- Algorithm design of an hybrid system embedding influence of soil for dynamic vibration control  
Eusebi, A., Corbi, O.  
(2015) *Soil Dynamics and Earthquake Engineering*
- Heterogeneously resistant elastic-brittle solids under multi-axial stress: fundamental postulates and bounding theorems  
Eusebi, A., Corbi, O.  
(2015) *Acta Mechanica*

View all 11 citing documents

Inform me when this document is cited in Scopus:  
Set citation alert | Set citation feed

Related documents

Find more related documents in Scopus based on:  
Authors | Keywords

23\_c032001-185.pdf - Adobe Reader

INTERNATIONAL JOURNAL OF MECHANICS

## Preservation Provisions for the Environmental Protection of Egyptian Monuments subject to Structural Vibrations

Ottavia Corbi, Abdel Hamid Zaghw, Adel Elattar, Ahmed Saleh

**Abstract**—The Egyptian area is characterized by a number of outstanding historical minarets, which represent a significant part of the monumental and architectural heritage of the country. Such structures usually are rather vulnerable as regards to environmental vibrations due to earthquakes, strong winds or even traffic vibrations, and proper protection strategies are required. In the paper some possible control devices are considered based on passive or semi-active control strategies, also making recourse to the adoption of smart materials.

**Keywords**— Historical constructions, Egypt, Environmental vibrations, Dynamic structural control, Control devices, Shape Memory Alloys.

**I. INTRODUCTION**

THE protection of ancient historical buildings requires the set up of strategies that are able to couple effectiveness, reliability and low invasiveness, in order to preserve the monumental apparatus of the construction with respect, for example, to environmental vibrations due to traffic, earthquakes or strong winds.

As regards seismic protection, advanced technologies may be conceived according to the special characters of the many structural typologies of historical monuments interesting the Mediterranean area.

There may be founded on structural control strategies aimed at the reduction of dynamic vibrations, both based on more classical passive systems or semi-active control systems adopting new materials such as Shape Memory Alloys.

Control systems based on smart strategies couple have been demonstrated to be able to couple high potential effectiveness with robustness and low operative costs, thus offering some clear advantages both with comparison to passive or active control systems.

The Egyptian area is characterized by many minaret constructions, with Cairo city used to be named the city of one thousand minarets [1], because of a large inventory of historical Islamic minarets that date back to the early Islamic period (641 A.D). Following the 1992 Dahshut earthquake, large numbers of these minarets were recorded to experience different levels of damage. Examining damage records indicated that minarets built during the Mamluk period were among the most severely hit. Irregular mass and stiffness distributions along their heights with large deployed inlaid carving made them more vulnerable to damage during earthquakes compared to other minaret styles [2].

In the current research, the dynamic characteristics of an outstanding Mamluk-Style minaret are investigated and possible applications of classical or smart base isolation techniques are considered.

**II. THE QUINN MINARET**

The minaret is the Quinn minaret (1337 A.D., 736 H.D) located in El-Sayut (eastern) on the southern side of the Salahi El-Din citadel. The minaret is currently separated from the surrounding building and is directly resting on the ground (no vaults underneath). The total height of the minaret is 40.28 meters with a base rectangular shaft of about 3.42 × 5.20 m.

Field investigations were conducted to obtain: (a) geometrical description of the minaret, (b) material properties of the minaret stone, and (c) soil conditions at the minaret location. Ambient vibration tests were performed to determine the modal parameters of the minaret such as natural frequencies and mode shapes.

Experimental results were used along with the field investigation data to develop a realistic 3-D finite element model that can be used for seismic risk evaluation of the minaret.

Examining the refined finite element model under different seismic excitations indicated the vulnerability of such structure to earthquakes with medium to high  $\alpha/\beta$  ratio. (Usually masonry structures are, anyway, affected by high seismic vulnerability [3], [4]).

Possible application of classical or smart base isolation

Issue 3, Volume 7, 2013 172

Strumenti | Compila e firma | Commento

Esporta PDF

Adobe ExportPDF  
Convertire file PDF online in formato Word o Excel.

Seleziona file PDF:  
23\_c032001-185.pdf 1 file / 7.44 KB

Converti in:  
Microsoft Word (\*.docx)

Riconosci testo in English(US.)  
Modifica

Converti

► Crea PDF  
► Modifica PDF  
► Combina PDF  
► Invia file  
► Archivia file