NOVATEUR PUBLICATIONS
International Journal of Research Publications in Engineering and Technology [IJRPET]
ISSN: 2454-7875
VOLUME 3, ISSUE 5,May -2017

FORCED VIBRATION ANALYSIS OF INVERTED UMBRELLA ROOF SHELL USING ANSYS

S. S. KADAM,
Department of Civil Engineering, Deogiri Institute of Engineering And Management Studies, Dr. BAMU University, Aurangabad, Maharashtra, India.

G. R. GANDHE
Department of Civil Engineering, Deogiri Institute of Engineering And Management Studies, Dr. BAMU University, Aurangabad, Maharashtra, India.

D. H. TUPE
Department of Civil Engineering, Deogiri Institute of Engineering And Management Studies, Dr. BAMU University, Aurangabad, Maharashtra, India.

ABSTRACT:

A Inverted Umbrella Roof Shell, treated from the Analytical based software in ANSYS and Statistically aspects, is a analyzed in this paper. In the Analytical sense, it is the solid shell of a great frequency and wide usability in a spatial structures, either as the complete form or in the parts. In the statistically regression analysis on graphs results sense, it is treated on the graphically results on which it is possible to the determine the exacts frequency on at each modes and field of the infinitesimal maximum deformations, and it is rigid by using Ferrocement.

1. INTRODUCTION:

The forced vibration analysis of a shell structures plays an the important role in a engineering applications as shells are widely used as a structural components. Due to the limitations of the analytical methods for practical applications, numerical methods are become the most widely used as a tool for the designing of shell structures. One of the most popular as numerical approaches for the analyzing vibration characteristics of the shells is the Finite Element Method (FEM). Shells of the double curvature are found to be the more advantageous of than shells of single curvature. The very large spaces can be mastered only by the doubly curved shells. A shell structure is the three dimensional structure, thin in a one direction and long in the other two directions. Such structures are the abundantly found in the nature, the shell of an egg is an the impressive example. The development stemmed from the need to cover medium to large spans economically and from a fascination with a new material: reinforced concrete. Concrete shells include single curved shapes such as cylinders and cones and double curved geometries such as domes which are either synclastic (curves running in the same direction) or anticlastic (curves running in opposite directions).

2. RELATED WORK

Li Hua and k.y. Lam (1996) [1] In this paper, the generalized differential quadrature (GDQ) method is used for the first time to study the effects of boundary conditions on the frequency characteristics of a thin rotating cylindrical shell. The present analysis is based on Love-type shell theory and the governing equations of motion include the effects of initial hoop tension and the centrifugal and coriolis accelerations due to rotation. **Ljubica Velimirovic (2000) [2]** In this paper, a hyperbolic paraboloid, treated from the constructional and mathematical aspects, is analyzed. In the constructional sense, it is a thin shell of a great bearing capacity and wide usability in spatial structures, either as a complete form or in parts. **A.M. Nasir et al. (2001) [3]** In this paper, the free vibration and seismic response of hyperbolic shells, and examines the influence of thickness, height and curvature on this response. The response of the first lateral mode is also significantly affected by a change in the parameters. **Francesco Tornabene and Alessandro Ceruti (2012) [4]** In this paper, the static and dynamic analyses of laminated doubly-curved shells and panels of revolution resting on Winkler-Pasternak elastic foundations using the Generalized Differential Quadrature (GDQ) method.

3. METHODOLOGY

Inverted Umbrella shell Roof in quadrilateral ground plan are considered for the investigation. Numerical approach using the advanced finite element analysis based software called as ANSYS 15 is adopted. Based on the reported literature of similar nature FE model is developed and the study is conducted to a investigate the behaviour of Inverted Umbrella shell Roof under the uniformly distributed Pressure load.

4. PROBLEM DESCRIPTION

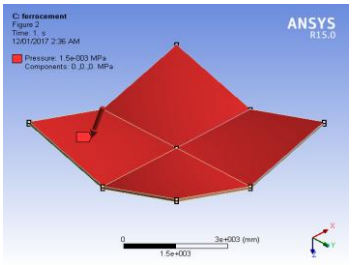

Fig 1 Model of Inverted Umbrella Shell Roof applying pressure load on downward direction

Table 1 Material properties of Ferrocement

Properties	Ferrocement
Young's modulus	79056Mpa
Density	2000Kg/m^3
Tensile ultimate strength	250Mpa
Poisson's ratio	0.3

Table 2 Model Geometry For Inverted umbrella shell roof

Geometry parts		Ferrocement
Bounding Box	Length X	6000 mm
	Length Y	6000 mm
	Length Z	1110.7 mm
Statistics	Nodes	117728
	Elements	20808

DETAILS OF ELEMENT USED

In hyperbolic paraboloid inverted umbrella shell roof the quadrilateral fine element are used in ANSYS Solid186 element are used. This element is used for the three-dimensional modeling of solids. The element is found out by 117728 nodes in Inverted umbrella shell roof having six degrees of freedom at each node, translations in the nodal X, Y, and Z directions. This is also suitable for analyzing the thin to moderately-thick shell structures.

5. RESULTS AND DISCUSSION:

Finite Element Analysis of Inverted umbrella roof shell subjected to pressure load using Modal analysis for Ferrocement

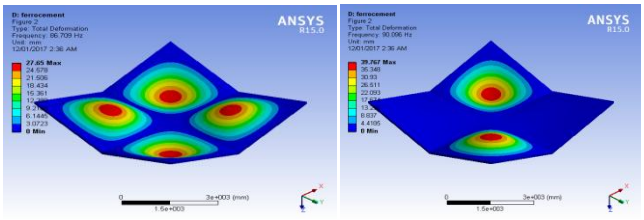

Fig 2 Total def. of Mode 1 for Ferrocement
Fig 3 Total def. of Mode 2 for Ferrocement

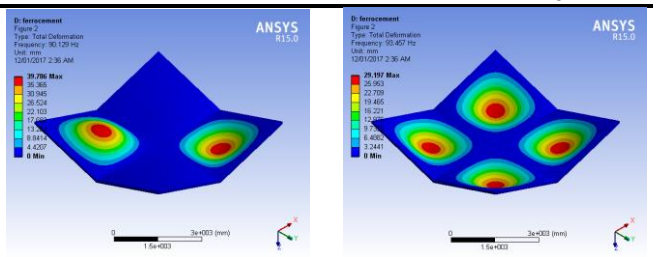

Fig 4 Total def. of Mode 3 for Ferrocement
Fig 5 Total def. of Mode 4 for Ferrocement

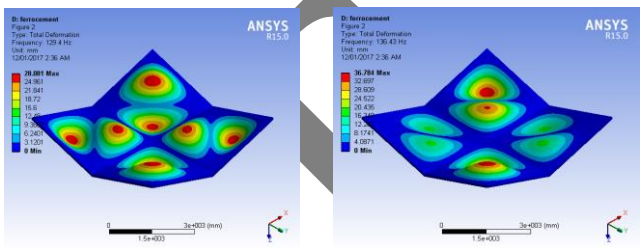

Fig 6 Total def. of Mode 5 for Ferrocement
Fig 7 Total def. of Mode 6 for Ferrocement

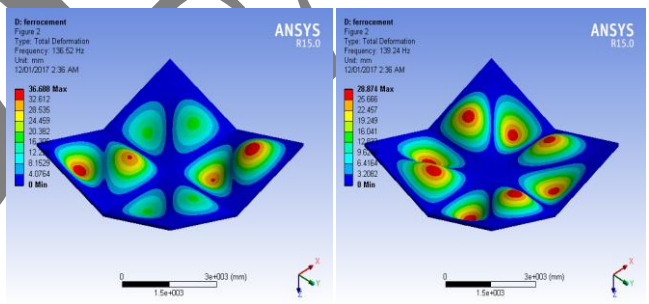

Fig 8 Total def. of Mode 7 for Ferrocement
Fig 9 Total def. of Mode 8 for Ferrocement

Above Fig 2, Fig 3, Fig 4, Fig 5, Fig 6, Fig 7, Fig 8 and Fig 9 shows the frequency of Inverted Umbrella Shell Roof of eight modes of on the structure

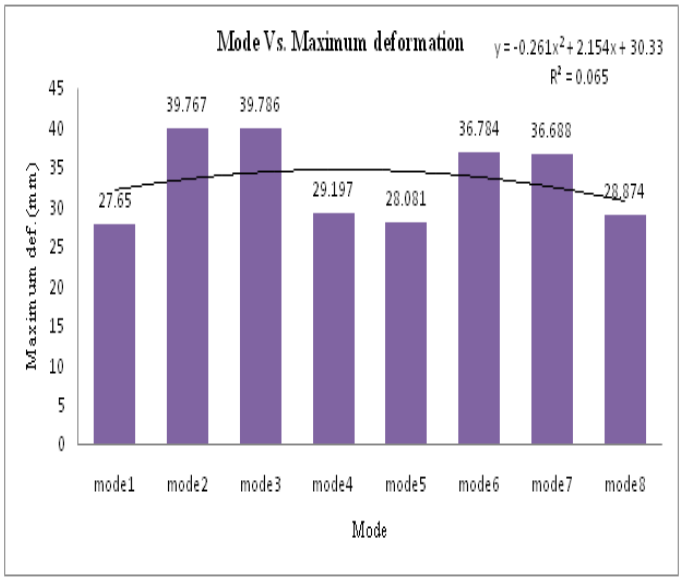

Fig 10 Variation of Maximum deformation of Inverted Umbrella Shell Roof subjected to Forced vibration analysis using Ferrocement.

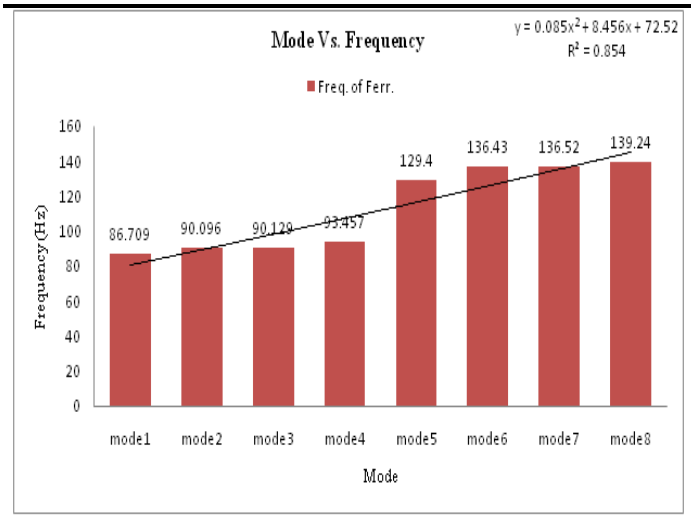

Fig 11 Variation of Frequency of Inverted Umbrella Shell Roof subjected to Forced vibration analysis using Ferrocement.

Above Fig 10 and Fig 11 shows the Variation of maximum deformation and frequency on inverted umbrella shell roof subjected to forced vibration analysis using ferrocement.

Table 3 Results of Maximum deformation and Frequency of Inverted Umbrella Shell Roof using Ferrocement compared with statistical regression analysis subjected to forced vibration analysis

Case		Ferrocement	R^2
Inverted Umbrella Shell Roof	Maximum def. (mm)	39.786 (3rd mode)	0.0651
	Frequency (Hz)	90.129 (3rd mode)	0.854

Above table shows the results of Maximum deformation on 3rd mode is 39.786mm and Frequency on 3rd mode is 90.129 and R^2 value of Maximum deformation is on statistical method means regression analysis on graphical representation is 0.0651 and Frequency is 0.854 respectively.

6. CONCLUSION:

In this study, The finite element analysis of static structural analysis and modal analysis were performed based software ANSYS (V15) for Inverted Umbrella Shell Roof (Hyperbolic paraboloid shell). Using Ferrocement material compared with regression statistical method on graphically representation.

1. The results obtained by the present analysis are accurate as seen in modal analysis also is compare with regression analysis.
2. The present analysis gives the realistic results of Maximum deformation for the Inverted Umbrella Shell Roof subjected to pressure load acting on top face downward direction is in excellent agreement with that regression analysis.
3. From the graph we can conclude that Maximum deformation and frequency up to eight mode is excellent agreement with regression analysis using Ferrocement for Inverted Umbrella Shell Roof.

REFERENCES:

1) Ljubica Velimirović, Grozdana Radivojević and Dragan Kostić *"Analysis Of Hyperbolic Paraboloids At Small Deformations"* UDC692.1/.6:539.37:514.13:519.633(045.) (2000).
2) Nhon Nguyen-Thanh, Chien Thai-Hoang, Hung Nguyen-Xuan, and Timon Rabczuk *"A Smoothed Finite Element Method for the Static and Free Vibration Analysis of Shells"* Journal of Civil Engineering and Architecture, ISSN 1934-7359, USA, Volume 4, No. 9 (Serial No.34). (2010).
3) A. K. Aditya and J. N. Bandyopadhyay et al. *"Study Of The Shell Characteristics Of a paraboloid Of Revolution Shell Structure Using The Finite Element Method"* Computers and structures volume 32,No. 2, pp.423-432 (1988).
4) Harish B. A, N. Venkata Ramana and K. Manjunatha *"Finite Element Analysis of Doubly Curved Thin Concrete Shells"* International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 4, Issue 5, ISSN: 2319-5967, (2015).