ISSN(Online) : 2319-8753
ISSN (Print) : 2347-6710

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 8, August 2015

Effect of Type of Connection on Dynamic Response of Double layer Grid Space Frames

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ABSTRACT:One of the important issues that must be taken into consideration in the analysis and design of space frames is the dynamic excitation. The dynamic behaviour of a space frame can be studied first through the vibration characteristics of the structure that is represented by its natural frequencies. One way to view the dynamic structural behaviour of orthogonal square pyramid space grid is to apply dynamic wave load. Finite element analysis package SAP2000 V.15.01 Ultimate was used to study the dynamic behaviour by means of time history function. This paper is aiming to investigate the structural behaviour of orthogonal square pyramid space grid under dynamic load, in which pyramid units with a square base are used. However, the structural behaviour depends on the type of connection. The results showed that for orthogonal square pyramid space grid, the type of connection has no effect on the collapse load and maximum displacement.

KEYWORDS: Space Frames, Double Layer Grid, Dynamic Response, Type of Connection

I. INTRODUCTION

The definition of space frame can quoted from working group on spatial steel structure of International Association on Shell and Spatial structure in 1984 : "Space frame is structural system assembled of linear elements, so arranged that the forces are transferred in a three dimensional manner". In some, the constituent element may be two dimensional. Macroscopically a space frame often takes the form of flat or curved surface [1].Also there is a second definition that can be also quoted from the American society of civil engineers report in 1976 entitled lattice structures: state -of-the-art report as space frame defined as lattice structure:" a latticed structure is a structure system in the form of network of elements (as opposed to a continuous surface). Rolled, extruded or fabricated sections comprise the member elements. Another characteristic of the latticed structural system is that their load carrying mechanism is three dimensional in nature" [2].

II. RALATED WORK

A lot of studies were implemented on the space frames to investigate the behaviour of space frames under static load. One of these studies were introduced In [1975], by Gregorian [3],this study proposed to apply plastic method of analysis to the design of pin connected, double layer space grids, simply supported along the sides of a rectangle and carrying a uniform concentration of normal nodal loading applied to the upper layer of the structure. The results showed that the failure load would be given by the smallest of the three values of collapse load intensities of tension, compression and web element strength, and presented sufficient information of the selection of basic members. In [1984],Ermopoulos [4], suggested a simple relation for the direct estimation of space trusses height by presenting a series of calculations for estimating of the optimum height of space trusses at the stage of preliminary design, the procedure used does not require the use of computer. In [1988], Yu and Shanmugam [5], presented a modified stiffness matrix method for obtaining the elastic buckling load of semi rigid space frames and this method applied to semi rigid plane frames. This method considered the effect of flexure on axial stiffness, geometric changes and the effect. Parametric studies were made for single storey and double storey single bay space frames. The results have been shown