



Improving Seismic Performance of Single Layer Diamatic Domes via Pellevation

Maryam Daei¹, Rahima Haghani², Mehrdad Hejazi²

1- Assistant professor, Faculty of Engineering, University of Isfahan

2- Master of science student, Faculty of Engineering, University of Isfahan

3- Associated professor, Faculty of Engineering, University of Isfahan

m.daei@eng.ui.ac.ir
rhaghani_2011@yahoo.com
m.hejazi @eng.ui.ac.ir

Abstract

Among different types of space frames, single layer diamatic dome (SLDD) is superior structure that provides cost effective solution to cover the large areas without intermediate supports. Since changes on the geometry play a key role in the structural response of space frames, in this paper effects of applied pellevation with different geometries on improving seismic performance of SLDDs are studied. For this purpose, one group includes simple SLDDs with different ratio of rise to span has been created, and then different types of pellevation are applied to the first group in the three groups. The nonlinear dynamic time history analysis is performed for the defined groups and the structural behavior of different systems has been compared. The results show desirable effects on weight reduction of pellevated domes while the structural performance is improved. It is obtained that the weight of the dome can be reduced by about 16% via choosing a proper pellevation.

Keywords: Space frame, diamatic dome, Pellevation, Time history analysis, Optimum ratio of geometric.

1. Introduction

Space frame structures refers to those structures that, in essence, have dominant 3-dimensional behavior. They act such as the effect of none of the three dimensions can be ignorable on the behavior of the structure under the different loadings [1]. These structures are configured in a way that load transfer through structural elements is possible in 3 dimensions, the combination of configuration set, geometric form, external loads, internal forces and structural displacement are not in a plane and they are extended in to three dimensions. Space frame structures are used to cover large spans such as in sport stadiums, shopping centers, conference halls and etc. They are generally categorized in different groups include grids, barrel vaults and domes [2]. Domes benefit from a special importance because of their higher stability compared to other forms (because of having bifect or multifect curvature). Among different types of domes, diamatic forms are of more application because they don't have the most important problem of ordinary domes which is accumulation of members in the crown.

In the design of space frame structures which are used for covering large spans without middle columns, dynamic loads like earthquake play important role especially for structure located in high seismic factor zones. The important point is that the geometry of the structure and its changes are the main factor which can alter the seismic loading of the structure.

In this paper, the effect of pellevation and changing in its geometric on seismic performance of , single layer diamatic dome (SLDD) are investigated . In formex algebra pellevation is a function that combines different space frame structure for different purposes and makes a new structure which is a combination of previous structure with a completely different behavior [3]. The pellevated dome is an ordinary dome which the pellevation function is applied on it, therefore the geometry is changed, and it can be caused changes on the seismic loading. In this paper, the optimal pellevation geometry for SLDD is determined such that the seismic loading decreases.