بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قال الله تعالي:

اقْرَأْ بِاسْمِ رَبِّكَ الَّذِي خَلَقَ (1) خَلَقَ الْإِنْسَانَ مِنْ عَلَقٍ (2) اقْرَأْ وَرَبُّكَ الْأَكْرَمُ (3) الَّذِي عَلَّمَ بِالْقَلَمِ(4) عَلَّمَ الْإِنْسَانَ مَا لَمْ يَعْلَمْ(5).

سورة العلق الايات (1-5)

صَدَق اللَّه الْعَظِيْم.

DEDICATION

Firstly and finally, thanks to Allah for helping me to complete this project.

I would like to thank my parents.

To my wife

To my brothers and sisters.

To my friends for their support all study time.

Acknowledgment

First of all Thanks for **God** who help me to complete this works.

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ABSTRACT

In this study, the analysis of pin jointed dome roofs using the selected finite element method was analyzed linearly and nonlinearly. The analysis was carried out in order to provide the evaluation of the effect of non-linear analysis by AUTODESK ROBOT STRUCURAL ANALYSIS PROFESSINAL program.

Four cases were selected the Ascending roof towards the field, Curved roof, Star dome roof and Circular dome roof. The linear analysis was performed using the three-dimension frame element and optimal model was tested for each four cases. The non-linear analysis was carried out by applying incremental concentrated loads and (Newton Raphson) based solution with iteration of the solution in each increment value shown for the Ascending roof towards the field and Curved roof. The incremental loads led fast diverge in the result. The top of the dome in the form of the Star dome roof and Circular dome roof was clearly the results of the non-linear analysis, where the maximum difference in the displacement in the first 24% and 35% for the second, and the difference in stresses was 33% for the first and 43% for the second, which explains the importance of the non-linear analysis for these two cases.

المـــلـخـــــــص

في هذه الدراسه تم تحليل للقباب المفصليه الملاعب باستخدام طريقه العنصر المحدد تحليلاً خطياً وغير خطي بغرض تقويم أثر التحليل اللاخطي. تم التحليل باستخدام برنامج (الروبوت) حيث تم اختيار اربع حالات وهي سقف صاعد لأعلي , سقف مقوس ,سقف قبة بشكل نجم وسقف قبه دائرية. التحليل الخطي تم باستخدام عنصرالاطار ثلاثي الابعاد وتم اختيار النموذج لكل من الحالات الأربع ومن ثم بني التحليل اللاخطي علي النموذج الامثل لكل من الحالات الأربع أُجري التحليل اللاخطي بتطبيق احمال مركزه متزايده وبني الحل علي طريقه نيوتن رابسوان مع تكرار الحل في كل قيمه زياده في الحمل. اظهرت النتائج أن أثر التحليل اللاخطي قليل جداً للسقف الصاعد لأعلي والسقف المقوس وأدت زيادة الأحمال الي تباعد سريع للنتائج اما بالنسبة لسقف القبة بشكل نجم وسقف القبه الدائرية فقد ظهر اثر التحليل اللاخطي بوضوح حيث كان الفرق الاقصي في الازاحة 24% للاول و35% للثاني والفرق الاقصي في القوي الداخليه 24% للأول و43% للثاني ، مما يوضح اهمية التحليل غير الخطي لهاتين الحالتين.

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LIST OF SYMBOLS

L - bar length

$\{d^e\}$ - displacement at any point.

[N] – the matrix of shape functions.

{de}-the vector of the local nodal displacements.

ε - Strain

[B] - Strain matrix

[D] – models matrix.

$\{\sigma\}, \sum$ - the stress.

$[k^e]$ – element stiffness matrix in local coordinate.

T – Transformation matrix.

K^e - element stiffness matrix in global coordinate.

Nx - axial force.

My, Mz - bending moments.

Qy , Qz - shear forces.

Mx - torsional moment.

Ux ,U - Displacement in x-direction.

Uy ,V - Displacement in y-direction.

Uz , W - Displacement in z-direction.

ϕ , θ - rotation.

E - Young's modulus

G - shear modulus

ν - Poisson's ratio

fd - limit of elasticity

Ax - cross section area

Ix - torsional constant

Iz - moment of inertia - bending in YZ plane

ky, kz - correction coefficients for shear rigidity in Y and Z directions