

STRUCTURAL MODELLING AND NUMERICAL ANALYSIS OF THE PALACE OF SPORTS OF MEXICO CITY

Hiram Badillo-Almaraz*, Sergio G. De La Rosa-Najar[†], Agustín Orduña-Bustamante^{††} and Guillermo M. Roeder-Carbo^{††}

* Department of Civil Engineering
Universidad Autónoma de Zacatecas - UAZ
Av. R. López Velarde No. 801, 98060 Zacatecas, México
E-mail: hbadillo.civil@uaz.edu.mx, [†]sgdelarosa.civil.uaz@gmail.com, web page: www.uaz.edu.mx

^{††} School of Civil Engineering
Universidad de Colima -UCOL
Km 9 Colima-Coquimatlan Road, Colima, México
Email: aord@ucol.mx, groeder@ucol.mx

ABSTRACT

From the urban-architectural legacy of buildings constructed for the XIX Olympiad in Mexico City in 1968, one of the most important buildings is the Palace of Sports. This building, designed by the acclaimed architect Felix Candela, represents in many ways the masterpiece of this period. In this paper the structural modelling and numerical analysis of this iconic building of the Mexican architecture of the second part of the XX century is presented.

The spatial configuration of the building consists of a circular floor, with a geodesic dome composed of wooden tables with an approximate overall area of 27171 square meters. The dome consists of tubular aluminum hyperbolic paraboloids covered by a superstructure of wooden sheets protected with water-resistant copper, supported by large steel arches. The geometry of the dome of the palace of sports is formed by two concentric spheres. Two intersecting planes generate two families of arcs; one superior and another inferior united by metal crosses that serve as support for the hyperbolic paraboloids. Concrete pillars covered with brick on all four sides act as buttresses in inclined pillars in form of V that serve as supports to the external structure. The structure is designed based on straight lines with different inclinations, all reaching specific points to create the three-dimensional geodesic dome. The cupola of the palace forms a reticular dome of projection on a surface of revolution, forming a spherical grid as a solution to the framework of the metallic reinforcements which are formed by 22 trusses in the form of a cable-stayed arch with uprights and diagonals in the center forming a lattice of orthogonal cross arches with 5 m separation. The lateral arches have 132 m of span; meanwhile central arches cover 193 m of span. The main reinforcements rest on dices of reinforced concrete that in turn rest on reinforced concrete buttresses. Each of the dices and buttresses are joined by connection beams that have the capacity to absorb lateral loads as well as the thrust of the arches.

The numerical modelling performed on this study is achieved by means of a 3D finite element model in order to obtain the linear and non-linear response in terms of mechanical elements and damage indexes of the actual structure when subjected to gravity, wind and earthquake loadings. Finally, the main findings about the structural response of this historical building are given based on the FE analysis performed in order to identify risk scenarios and to prevent them to occur on such iconic structure.

REFERENCES

- [1] E. González Meza, “Estructuras de Reticula Triangular, Transformaciones Constructivas de las Edificaciones”, Tesis Doctoral, Universidad Politécnica de Madrid – Escuela Técnica Superior de Arquitectura- D.C.T.A., 2016.
- [2] F. L. del Blanco García y I. García Ríos, “De las estructuras laminares a las estructuras metálicas en la arquitectura de Félix Candela”, Análisis y reconstitución de la sala de exposiciones para el concurso del Palacio Olímpico de los Deportes, México 1968”, *Revista Indexada de datos académicos RITA*, Vol. **05**, pp. 98–11, (2016).