hypar TYPE ROOF STRUCTURE MODELING IN A UNPUBLISHED PROJECT BY FELIZ CANDELA IN CALI (Colombia)

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At beginnings of the second half of the twentieth century, the Hispanic – Mexican architect Felix Candela designed numerous buildings using reinforced concrete structures with double curvature geometry. Between these structural forms it was called "umbrella", resulting from the combination of hyperbolic parabolides (hypar) with a square or rectangular plan, limited by straight sections that are supported by a unique central support which usually accommodate the rainwater downspouts.

The aim of this work is carry out a numerical model of one of the unpublished projects designed by Félix Candela (Textile Factory "El Cedro") built in Cali (Colombia) between years 1959 and 1962, using umbrella type structures. The mechanics theory of continuous medium is used to the analysis, through finite elements techniques and the computational mechanics, with the aim is evaluate the validity of the demolition of this building in 1990 sustained by structural obsolescence criteria.

The numerical model was carried out by using the original drawings and data through the pre-and post-processing software GID. A mesh was elaborated by quadrilaterals elements generated in the median plane of the shell. The displacement field in the three coordinate directions and two rotations about tangential axes to the middle plane is a dependent variable on the mathematical model. The displacement at the shell thickness is obtained by a linear interpolation, then the strains and stress fields were calculated. The material used is reinforced concrete which is modeled as a linear, homogeneous and isotropic material. The implementation of mathematical model was carried out in MATLAB. The numerical results was compared with the original designs results, and was verified the compliance of the structural requirements for this kind of structures.

The results obtained allow to conclude the validity of the demolition of this building, based on structural and numerical principles used in this analysis. The numerical modeling of this structure using composite materials is proposed as a future work inside the investigation line.

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