

Finite Element Analysis of a Glass Facades Supported by Pre-Tensioned Cable Trusses

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Abstract : Significant technological advances have been achieved in the design and building construction of steel and glass in the last two decades. The metal glass support frame has been replaced by further sophisticated technological solutions, for example, the point fixed glazing systems. The minimization of the visual mass has reached extensive possibilities through the evolution of technology in glass production and the better understanding of the structural potential of glass itself, the technological development of bolted fixings, the introduction of the glazing support attachments of the glass suspension systems and the use for structural stabilization of cables that reduce to a minimum the amount of metal used. The variability of solutions of tension structures, allied to the difficulties related to geometric and material non-linear behavior, usually overrules the use of analytical solutions, letting numerical analysis as the only general approach to the design and analysis of tension structures. With the characteristics of low stiffness, lightweight, and small damping, tension structures are obviously geometrically nonlinear. In fact, analysis of cable truss is not only one of the most difficult nonlinear analyses because the analysis path may have rigid-body modes, but also a time consuming procedure. Non-linear theory allowing for large deflections is used. The flexibility of supporting members was observed to influence the stresses in the pane considerably in some cases. No other class of architectural structural systems is as dependent upon the use of digital computers as are tensile structures. Besides complexity, the process of design and analysis of tension structures presents a series of specificities, which usually lead to the use of special purpose programs, instead of general purpose programs (GPPs), such as ANSYS. In a special purpose program, part of the design know how is embedded in program routines. It is very probable that this type of program will be the option of the final user, in design offices. GPPs offer a range of types of analyses and modeling options. Besides, traditional GPPs are constantly being tested by a large number of users, and are updated according to their actual demands. This work discusses the use of ANSYS for the analysis and design of tension structures, such as cable truss structures under wind and gravity loadings. A model to describe the glass panels working in coordination with the cable truss was proposed. Under the proposed model, a FEM model of the glass panels working in coordination with the cable truss was established.

Keywords : Glass Construction material, Facades, Finite Element, Pre-Tensioned Cable Truss

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