World Academy of Science, Engineering and Technology
International Journal of Civil and Architectural Engineering
Vol:10, No:03, 2016

# Mechanical Behavior of Laminated Glass Cylindrical Shell with Hinged Free Boundary Conditions

**Authors :** Ebru Dural, M. Zulfu Asık

**Abstract :** Laminated glass is a kind of safety glass, which is made by 'sandwiching' two glass sheets and a polyvinyl butyral (PVB) interlayer in between them. When the glass is broken, the interlayer in between the glass sheets can stick them together. Because of this property, the hazards of sharp projectiles during natural and man-made disasters reduces. They can be widely applied in building, architecture, automotive, transport industries. Laminated glass can easily undergo large displacements even under their own weight. In order to explain their true behavior, they should be analyzed by using large deflection theory to represent nonlinear behavior. In this study, a nonlinear mathematical model is developed for the analysis of laminated glass cylindrical shell which is free in radial directions and restrained in axial directions. The results will be verified by using the results of the experiment, carried out on laminated glass cylindrical shells. The behavior of laminated composite cylindrical shell can be represented by five partial differential equations. Four of the five equations are used to represent axial displacements and radial displacements and the fifth one for the transverse deflection of the unit. Governing partial differential equations are derived by employing variational principles and minimum potential energy concept. Finite difference method is employed to solve the coupled differential equations. First, they are converted into a system of matrix equations and then iterative procedure is employed. Iterative procedure is necessary since equations are coupled. Problems occurred in getting convergent sequence generated by the employed procedure are overcome by employing variable underrelaxation factor. The procedure developed to solve the differential equations provides not only less storage but also less calculation time, which is a substantial advantage in computational mechanics problems.

**Keywords :** laminated glass, mathematical model, nonlinear behavior, PVB
**Conference Title :** ICCEAM 2016 : International Conference on Civil Engineering and Applied Mechanics
**Conference Location :** Rome, Italy
**Conference Dates :** March 21-22, 2016