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EFFECT OF DELAMİNATİON ON THE STRENGTH OF LAMINATED CURVED GLASS BEAM

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Laminated glass is made of two or more thin glass sheets bonded to each other by an interlayer with lamination process which is a manufacturing technique under at high temperature and pressure. The interlayer prevents the glass sheets from shattering and reduce the injuries caused by scattered glass pieces. Laminated glasses have long been used in the manufacturing of aircraft and automobile windscreens and nowadays they are widely used in the architectural components of the buildings. Despite the long history of the use of laminated glass in buildings there are serious problems about design and delamination of laminated glass units. This paper deals with the computational modeling of delamination of laminated glass curved beams. Delamination which is a common mode of failure can be described as reduction or, potentially, a total loss in the adhesive bond between the glass sheets and the interlayer.

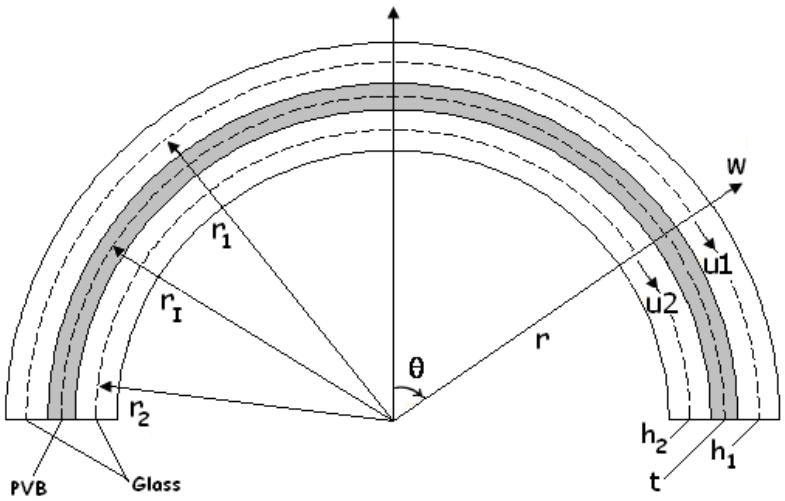

Figure 1. Laminated glass curved beam with an interlayer PVB

Total potential energy of the unit, shown in Figure 1, is written as the summation of bending, membrane, shear and force potential energies to obtain the governing differential equations in terms of displacements. By taking the first variation of the total potential energy of the unit with respect to the circumferential and radial displacements the governing differential equations are obtained. Finite Difference Method (FDM) is used to solve the governing equations. The nonlinear differential equations are converted into algebraic equations by using central finite difference method and written in matrix form.

To consider the effect of delamination on the behavior of curved laminated glass beams simply supported beams are considered in this study. It is assumed that there is no connection between the interlayer and glass sheets if there is delamination in a region. So the shear force which is transferred by PVB interlayer is assumed as zero for the delaminated regions. For this reason the terms which contains shear modulus is ignored and the governing differential equations are rearranged for the representation of delamination case.

Displacement moment and stress functions for laminated curved glass beam which has delaminations in different regions are given for the use in engineering practice to determine the strength of delaminated curved laminated glass beam.

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