

**Finite Element Analysis of  
a Pair of Leaning Pressurized Arch-Shells  
Under Snow and Wind Loads**

By

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(ABSTRACT)

A structure comprised of two arches that lean against each other at the apex is considered. The arches are thin shells with internal pressure. This type of structure with solid arches has been used in bridges, such as the Gateway Arch Bridge in Columbus, Indiana, U.S.A., the Monongahela River Bridge in Pittsburgh, Pennsylvania, U.S.A., and a pedestrian bridge at the Pacific Tower in Paris, France. A series of leaning arches was incorporated in the frame of the Museum of the Moving Image, a temporary structure in London, England, during 1992-1994. Pressurized arch-shells made of a flexible material have been utilized as part of the framework for some transportable tent-like structures.

The behavior of a pair of pressurized leaning arch-shells with various tilt angles, boundary conditions, and loads is investigated numerically. Several types of loads are considered, including uniformly-distributed vertical loads applied over all or half of the structure (representing snow), and wind loads on the structure. The arches are pinned or fixed to the ground. Deflections, vibrations, and stability of the structures are investigated using the finite element method. The effect of the tilt angle on the response is examined, and buckling may occur for some tilt angles under vertical loading. This type of structure has not been used widely, but may be effective for various applications.