SM22S_12420

XXI International Congress of Theoretical and Applied Mechanics
Warsaw, Poland, August 15–21, 2004

Instabilities of Initially Stressed Hyperelastic Cylindrical Membrane and Shell Under Internal Pressure

Djenane C. Pamplona, Paulo B. Goncalves, Stefane R.X. Lopes

Civil Engineering – PUC-Rio, Rio de Janeiro, Brasil

This paper investigates the static nonlinear behavior and possible instabilities of cylindrical membranes and shells experimentally and numerically using the Finite Element Method. A detailed experimental analysis was carried out involving cylindrical membranes and shells with different initial axial forces, internal pressures and imperfections. The specimens used in the experiments are considered as an isotropic, homogeneous and hyperelastic rubber, which is numerically modeled as a Neo-Hookean, Mooney-Rivlin or Ogden incompressible material. The structure was analyzed using appropriate membrane or shell finite elements and the resulting nonlinear equilibrium equations solved using the FE software ABAQUS. A detailed parametric numerical analysis was also carried out to study the influence of the initial traction and geometric parameters on the non-linear behavior and load carrying capacity of the structure. The influence of different types of local imperfections was also studied in detail.

View the extended summary