
Stability Analysis of an Inflated, Axially Extended, Residually Stressed Circular Cylindrical Tube

Andrey Melnikov*¹ and Jose Merodio

¹Nazarbayev University – Kazakhstan

Abstract

Residual stress may have an important influence on the mechanical response of residually stressed materials.

This paper is concerned with the effects of residual stress on the stability of inflated, axially extended, residually stressed circular cylindrical tube. To this end, the theory of small incremental deformations superimposed on a large underlying finite deformation is used. Asymmetric and axisymmetric types of bifurcation are considered. It is found that for residual stress parameter γ of the same sign the effect of the residual stress is different depending on the type of bifurcation. For example, for asymmetric bifurcations with mode number $m = 1$ and with positive γ inclusion of residual stress makes the tube more stable, on the other hand, for axisymmetric bifurcations inclusion of residual stress, corresponding to positive residual stress parameter γ , leads to increase of instabilities. In all cases, residual stress with positive and negative residual stress parameter γ leads to a symmetric character of bifurcation curves.

Keywords: Nonlinear elasticity; Residual stresses; Incremental elastic deformations; Tube bifurcation.

*Speaker