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PROCEEDINGS

Localized Necking and Bulging of Finitely Deformed Residually Stressed Solid Cylinder

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ABSTRACT

In this talk, we present some analytical results concerning localized instabilities in stretched soft cylinders with residual-stress effect. Within the framework of finite elasticity, a bifurcation analysis is carried out based on the incremental theory. It is found that with the residual stress effect taken into consideration additional singularities of the incremental equations appear. To overcome this difficulty we apply the Stroh formulism and an expansion methodology and derive a bifurcation condition. Then we consider three loading scenarios and perform a detailed analysis of the bifurcation behaviors. It turns out that the zero mode, giving rise to localization, is always preferred. In particular, an explicit bifurcation condition, namely, the derivative of the axial force with respect to the axial stretch is zero, is obtained. Furthermore, there exists a threshold of the residual stress or the specified resultant axial force, and below which no bifurcation is possible. Finally, some analytical insight is provided for the propagation of localized bulging or necking in light of Maxwell's equal area rule.

KEYWORDS

Bulging; necking; residual stress; finite elasticity; Stroh method; bifurcation analysis; Maxwell state

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