

MODIFIED UPDATED LAGRANGIAN FORMULATION FOR PRESTRESS STATE ESTIMATION IN KIRCHHOFF-LOVE THIN-SHELLS ANEURYSM MODELS

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Keywords: Aneurysm biomechanics, prestressed state, cerebral aneurysms

Abstract. Cerebral aneurysms are a pathology of particular interest due to their association with stroke, one of the main causes of death and disability in adults. Their biomechanical characterization is believed to be a key factor in understanding and preventing aneurysm rupture. However, developing biomechanical models of the arterial wall and aneurysms poses a significant challenge due to the intricate biological phenomena and processes involved. In previous studies we modeled the effect of localized loads near the aneurysm neck, aimed to identify mechanically sensitive regions. Deformation kinematics were described using a geometrically nonlinear thin-shell model of non-uniform thickness based on Kirchhoff–Love assumptions, combined with a Saint-Venant hyperelastic constitutive formulation. Since we focused on developing a pipeline for biomechanical analysis we considered an initial stress-free configuration without taking into account the effect of blood pressure, a key factor in arterial wall behavior. In this work, we develop a thin-shell formulation of the Modified Updated Lagrangian Formulation—a method for estimating the prestressed state—for the analysis of patient-specific aneurysm geometries retrieved from the AneuriskWeb open database.