Invariant Theory for Dispersed Transverse Isotropy: An Efficient Means for Modeling Fiber Splay

By -

BiblioGov. Paperback. Book Condition: New. This item is printed on demand. Paperback. 32 pages. Dimensions: 9.7in. x 7.4in. x 0.1in.Most soft tissues possess an oriented architecture of collagen fiber bundles, conferring both anisotropy and nonlinearity to their elastic behavior. Transverse isotropy has often been assumed for a subset of these tissues that have a single macroscopically-identifiable preferred fiber direction. Micro-structural studies, however, suggest that, in some tissues, collagen fibers are approximately normally distributed about a mean preferred fiber direction. Structural constitutive equations that account for this dispersion of fibers have been shown to capture the mechanical complexity of these tissues quite well. Such descriptions, however, are computationally cumbersome for two-dimensional (2D) fiber distributions, let alone for fully three-dimensional (3D) fiber populations. In this paper, we develop a new constitutive law for such tissues, based on a novel invariant theory for dispersed transverse isotropy. The invariant theory is based on a novel closed-form splay invariant that can easily handle 3D fiber populations, and that only requires a single parameter in the 2D case. The model is polyconvex and fits biaxial data for aortic valve tissue as accurately as the standard structural model. Modification of the fiber stress-strain law requires no re-formulation...

Reviews

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