MATERIAL FORCES IN THE CONTEXT OF BIOTISSUE REMODELLING

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Remodelling of biological tissue due to a change in microstructure is treated in the continuum mechanical setting. Microstructural change is expressed as an evolution of the reference configuration, Ω_0. This evolution is expressed as a point-to-point map $\boldsymbol{X}^* = \kappa(\boldsymbol{X}, t)$ of Ω_0 to a new reference configuration, Ω_0^*. A "preferred" change in reference configuration is considered in the form of a globally incompatible tangent map, $\boldsymbol{F}^{\mathrm{r}}$. This field could be experimentally determined, or posed as an ansatz. In general, it will depend upon stress, density, temperature and any internal variables that are appropriate. The questions of global compatibility, and evolution equations for the resulting configurations are addressed and a solution is presented.

Well-known quantities such as the Eshelby stress tensor, and thermodynamic driving forces arise in this formulation, which is recognized as describing a process of self-assembly. Furthermore, some familiar solutions of problems involving changes in reference configuration are recovered.