energy density as two mutually exclusive quantities; thermal and mechanical changes become two aspects of the same process that coexist and are in continual operation. This is accomplished by interlacing the rotation, deformation and change in element size into one single operation; irreversibility is embedded inherently into the theory. No a priori assumption needs to be made on the constitutive relations which are, in fact, derived for each individual element and time increment. Only the initial slope of the reference material and load history need to be specified. Instead, the surface and volume energy density are assumed to be exchangeable without letting the change of volume with surface area to vanish in the limit, a simplification of classical physics and continuum mechanics that results in the decoupling of thermal and mechanical effects. Complete nonlinearity and finiteness of deformation are retained such that boundary problems can be solved directly by specifying the tractions and/or displacements. Nonequilibrium/irreversible solutions are shown to possess definite limits and to be bounded by the equilibrium / irreversible states whose solutions are proved to be unique. The existence of the isoenergy density function provides an elegant means of resolving the multidimensionality of the problem; the translation of unidimensional data to multidimensional states.

Keywords *nonequilibrium; irreversibility; thermomechanics; dissipation energy density; available energy density; isoenergy density; isoenergy surface*

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