A NEW ADDITIONAL ROLE FOR THE CLAUSIUS-DUHEM INEQUALITY

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ABSTRACT

Traditionally, the role of being a source of constitutive restrictions and compatibility or stability conditions is attributed to the second law of thermodynamics written as the Clausius-Duhem inequality. We show that another fundamental role pertains to it. Specifically, we prove that the basic structures of phase-field models for phase-transitions in non-isothermal setting and (in general) bodies with 'active' microstructures can be derived all together from a unique principle requiring structure invariance of the second law of thermodynamics, written as a Clausius-Duhem inequality, under orientation-preserving diffeomorphism-based changes of observer and standard regularity conditions [1]. We show also that the microstructural behavior can be responsible of effects leading to wave-type heat propagation. When we consider a body with evolving macroscopic defect and a version of the Clausius-Duhem inequality that includes a power written with respect to a virtually varying reference configuration (a choice that is appropriate for a virtual representation over the reference configuration of the defect evolution), the above invariance requirement allows one to get directly the above results but also the local balances of configurational actions [2].

REFERENCES

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