FLUCTUATING BOUNDARIES BETWEEN MECHANICS AND THERMODYNAMICS

Paolo Maria Mariano[1]*

[1]DICEA, University of Florence, via Santa Marta 3, I-50139 Firenze, Italy
*paolomaria.mariano@unifi.it

ABSTRACT

Is there any fixed boundary from what we call mechanics and what we describe in terms of heat along general processes? To try to formulate at least an attempt at an answer, consider a molecular cluster and a related discrete-to-continuum approach to its dynamics. We can first associate with averages the structures that we attribute to mechanics (say those described by the balance equations of forces and couples), so that heat is described by fluctuations [1]. However, in a multi-scale view of the discrete-to-continuum transition, we can also decompose in some way the fluctuations, considering a portion of them (one defined in appropriate way) as contributing to mechanics while the remaining part of fluctuations as associated with heat [2], [3]. We discuss both circumstances and the related notions of temperature that may be defined.

REFERENCES

[1] W. Noll, Die Herleitung der Grundgleichungen der Thermomechanik der Kontinua aus der statistichen Mechanik, *J. Rational Mech. Anal.*, vol. 4, 627-646, 1955.
[2] G. Capriz and P. M. Mariano, Interactions in a multi-scale representation of sparse media: from mechanics to thermodynamics, *J. Elasticity*, vol. 135, 91-115, 2019.
[3] P. M. Mariano, From clusters of moving molecules to continua: material elements as open systems, *Eur. J. Mech. A/Solids*, vol. 106, art. n. 105310, 2024.