Extended Thermodynamics from the Lagrangian view-point

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Extended Thermodynamics (E.T.) is a powerful and well established theory (see [1] as example). It leads to first order quasi-linear symmetric hyperbolic systems of field equations, guarantees the well-posedness of initial value problem and finite speeds of propagation. Usually it is formulated from the Eulerian view-point: For every point $\underline{x}$ and time t, attention is focused to the physical properties of the material particle transiting trough that position at the time t. In this talk it will be shown how the same considerations may be followed from the Lagrangian view-point: Attention is focused to each material particle and to its physical properties, during all the motion of the same particle.

The conservation laws of mass, momentum and energy, from the Lagrangian view-point, have already been treated in literature (see, for example, the textbook [2] from page 64). Here a similar procedure is followed for all the balance laws of E.T. with an arbitrary number of moments.

It is also shown how the Galilean Relativity Principle and some symmetry condition, which are present in the Eulerian view-point, can be "translated" in the Lagrangian view-point, where they are no more so self-evident.

This treatment may be applied to many possible physical situations, for example to semi-conductors, to E.T. of a moving surface and of an extensible wire.

References

[1] Müller I., Ruggeri T. *Rational Extended Thermodynamics, 2th Edition.* Springer Tracts in Natural Philosophy, Springer-Verlag, N.Y. (1998)

[2] Ruggeri T. *Introduzione alla Termomeccanica dei Continui.* Monduzzi Editore, Bologna (2007)