Tue2.1 Llor, Bailly & Poujade

Derivation of a minimal 2-structure, 2-fluid and 2-turbulence (2SFK) model for gravitationally induced turbulent mixing layers.

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A new modelling concept for the statistical description of gravitationally induced turbulent mixing layers was previously introduced in a preliminary communication [Llor & Bailly 2003]. Central to this concept, called 2SFK which stands for 2 Structures (meaning: turbulent structures), 2 Fluids and 2 turbulent fields (K), is the fact that the observed average geometrical (Dimonte 2000) and turbulent (Llor 2003) length scales are astonishingly similar in a Rayleigh-Taylor mixing zone. The relevant transport entities to consider in describing its evolution are not only the fluids themselves but the turbulent structures as well. This similarity was taken as a general basic assumption for modelling.

Within the same general framework, we here outline a more systematic, consistent and parsimonious model. First, the turbulent kinetic energy is analysed and decomposed into canonical contributions (in a sense to be defined) which participate in the definition of the Lagrangian of the physical system. Then, Hamilton's least action principle is applied to get a conservative set of equations. And finally, an extension of the thermodynamics of irreversible processes is used to complete the model.

This new approach (Llor, Bailly & Poujade 2004) conforms to some essential physical features in addition to those previously mentioned: (i) it takes into account a consistent buoyancy-drag balance between structures thanks to mass exchange terms; (ii) it captures the four basic mean self-similar parameters (bubble and spike growth coefficients, and for vanishing Atwood numbers, mean effective Knudsen number of turbulent transport, mean molecular mixing fraction and mean Reynolds tensor anisotropy); (iii) it is hyperbolic; (iv) and it is minimal. A sample of graphic materials are shown and a more extensive illustration will be presented at the poster session.

References

LLor, A. & Bailly, P. 2003 A new turbulent 2-field concept for modelling RT, RM and KH mixing layers; *Laser Part. Beams* (in press).

Dimonte, G. 2000 Spanwise homogeneous buoyancy-drag model for RT mixing and experimental evaluation; *Phys. Plasma* **7**(6), 2255.

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