Recent Developments in Extended Thermodynamics of Gases

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Recently extended thermodynamics (ET) of rarefied polyatomic gases and of dense gases has been proposed [1-3]. The most typical one is the ET theory with 14 fields (ET14): mass density, velocity, temperature, shear stress, dynamic pressure (non-equilibrium pressure), and heat flux. A remarkable feature of the theory is that it is composed of parallel hierarchical series of field equations of balance type, that is, the momentum series and the energy series. The theory is a natural extension of the well-known Navier-Stokes Fourier theory for viscous and heat-conducting fluids. By applying the constitutive theory of ET, the constitutive equations can be determined explicitly by the thermal and caloric equations of state together with the experimental data on the shear viscosity, the bulk viscosity and the heat conductivity. In the case of rarefied polyatomic gases, the theory is fully consistent with the moment equations derived from the kinetic theory of polyatomic gases.

The aim of the present talk is to make a review of the recent developments in the ET theory beyond the monatomic gas and to show some of its applications.

References

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