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On the structure of distribution function in kinetic methods and its implications LIAN-PING WANG, Southern U of Sci and Tech and U of Delaware — This theoretical talk will provide a derivation of the structure of the distribution functions in kinetic schemes such as the lattice Boltzmann method and the discrete unified gas kinetic scheme. Starting from the continuous Boltzmann equation with the BGK collision model and an external force field, the structure of the distribution functions, in terms of the macroscopic variables, is derived by using only the Chapman-Enskog expansion for continuum flows. The result can be used to understand why a source term in the kinetic equation can be designed to adjust fluid viscosity and thermal conductivity, *etc.* The structure of the discrete distribution functions used in the kinetic methods is then derived by proper transformation and the use of Gauss-Hermite quadrature. The result then provides a basic framework to discuss proper implementation of boundary condition in the kinetic methods. Previous boundary implementation methods will be examined under this framework and alternative boundary implementation methods will be explored. Possibility of using this approach to explore truncation errors in kinetic methods will also be discussed.

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