General form of the Maxwellian distribution with arbitrary density

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The kinetic Boltzmann equation is one of the central equations in classical mechanics of many-particle systems. For the model of hard spheres it has a form [1, 2]:

$$D(f) = Q(f, f). \tag{1}$$

As, analogous to [3], we will also consider the distribution function of the form:

$$f = \int_{\mathbb{R}^3} du \int_0^{+\infty} d\rho \, \varphi(t, x, u, \rho) M(v, u, \rho), \tag{2}$$

which contains the global Maxwellian

$$M(v, u, \rho) = \rho \left(\frac{\beta}{\pi}\right)^{\frac{3}{2}} e^{-\beta(v-u)^2}. \tag{3}$$

It is required to find $\varphi(t, x, u, \rho)$ and the behavior of all parameters so that the uniform-integral (mixed) or pure integral remainder [4], i.e. the functionals of the form

$$\Delta = \sup_{(t,x)\in\mathbb{R}^4} \int_{\mathbb{R}^3} |D(f) - Q(f, f)| dv, \tag{4}$$

$$\Delta_1 = \int_{R^1} dt \int_{R^3} dx \int_{R^3} |D(f) - Q(f, f)| dv, \tag{5}$$

become vanishingly small.

In this work we succeeded a few to generalize results, which obtained in [3], where distributions generalize bimodal distributions obtained earlier. It was assumed that the mass velocity of the global Maxwellian does not take fixed discrete values and becomes an arbitrary parameter taking any values in $\mathbb{R}^3$. Now we constructed the continual approximate solution of the Boltzmann equation (1) with arbitrary density [5].

Also some sufficient conditions which minimized the uniform-integral remainder and pure integral remainder between the left- and the right-hand sides of this equation are founded.

References

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