plasma system where the parallel electric field effects are negligibly small.

Because the plasma usually has anisotropic pressure in space environment and large magnetic fusion devices, we consider the momentum equation with anisotropic pressure

$$\rho \frac{d}{dt} \mathbf{V} = -\nabla \cdot \mathbf{P} + \mathbf{J} \times \mathbf{B}, \tag{1}$$

where $(d/dt) = (\partial/\partial t) + \mathbf{V} \cdot \nabla$ is the total time derivative, $\mathbf{V}$ is the fluid velocity, $\mathbf{B}$ is the magnetic field, $\mathbf{P}$ is the pressure tensor due to all particle species, and ρ is the total plasma mass density. The density continuity equation is given by $d\rho/dt + \rho \nabla \cdot \mathbf{V} = 0$. The Ohm's law is given by $\mathbf{E} + \mathbf{V} \times \mathbf{B} = \eta \mathbf{J}$, where $\mathbf{E}$ is the electric field and η is the plasma resistivity. The Maxwell's equations hold: the Faraday's law, $\partial \mathbf{B}/\partial t = -\nabla \times \mathbf{E}$; the Ampere's law, $\mathbf{J} = \nabla \times \mathbf{B}$; and $\nabla \cdot \mathbf{B} = 0$. The total plasma pressure can be expressed as $\mathbf{P} = P_\perp \mathbf{I} + (P_{||} - P_\perp)\mathbf{BB}/B^2$, where $P_{||}$ and $P_\perp$ are the parallel and perpendicular pressures, respectively, and contain both the core and hot plasma pressures. To close the above equations we need to prescribe the pressure. Because the hot plasma density is much smaller than the core plasma density we employ the double-adiabatic pressure laws to relate the core plasma pressure to the plasma density;

$$\frac{d}{dt}\left(\frac{P_{||c} P_{\perp c}^2}{\rho^5}\right) = 0 \tag{2}$$

and

$$\frac{d}{dt}\left(\frac{P_{\perp c}}{\rho B}\right) = 0. \tag{3}$$

For the hot component we account for particle kinetic effects, such as finite Larmor radius and wave-particle resonances, by obtaining the parallel and perpendicular pressures from the hot particle distribution function f by

$$\begin{aligned} P_{||h} &= \sum_j m_j \int d^3v \; v_{||}^2 f_j \\ P_{\perp h} &= \sum_j \frac{m_j}{2} \int d^3v \; v_\perp^2 f_j \end{aligned} \tag{4}$$

where the summation in j is over all hot particle species, m is the particle mass, and $v_{||}$ and $v_\perp$ are the particle velocity parallel and perpendicular to the magnetic field $\mathbf{B}$, respectively.