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**Research Article**

# Transport Equations of Three-point Distribution Functions in MHD Turbulent Flow for Velocity, Magnetic Temperature and Concentration

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**Abstract:** In this study, the statistical theory of certain distribution functions for simultaneous velocity, magnetic temperature and concentration fields in MHD turbulent flow have been studied. The various properties of the constructed joint distribution functions such as, reduction property, separation property, coincidence and symmetric properties have been discussed. We have made an attempt to derive the transport equations for two and three point distribution functions. Lastly, the transport equation for evaluation of three point distribution functions has been derived.

**Keywords:** Concentration, magnetic temperature, MHD turbulent flow, three-point distribution functions, transport equation

## INTRODUCTION

At present, two major and distinct areas of investigations in non-equilibrium statistical mechanics are the kinetic theory of gases and statistical theory of fluid mechanics. In molecular kinetic theory in physics, a particle's distribution function is a function of several variables. Particle distribution functions are often used in plasma physics to describe wave-particle interactions and velocity-space instabilities. Distribution functions are also used in fluid mechanics, statistical mechanics and nuclear physics. A distribution function may be specialized with respect to a particular set of dimensions. Distribution functions may also feature non-isotropic temperatures, in which each term in the exponent is divided by a different temperature. The mathematical analog of a distribution is a measure, the time evolution of a measure on a phase space is the topic of study in dynamical systems. Various analytical theories in the statistical theory of turbulence have been discussed in the past by Hopf (1952), Kraichanan (1959), Edward (1964) and Herring (1965). Further Lundgren (1967) derived a hierarchy of coupled equations for multi-point turbulence velocity distribution functions, which resemble with BBGKY hierarchy of equations of Ta-You (1966) in the kinetic theory of gasses. Bigler (1976) gave the hypothesis that in turbulent flames, the thermo chemical quantities can be related locally to few scalars and considered the probability density function of these scalars. Kishore (1978) studied the Distributions functions in the statistical theory of MHD turbulence of an incompressible fluid. Pope (1979) studied the statistical theory of turbulence flames. Pope (1981) derived the transport equation for the joint probability density function of velocity and scalars in turbulent flow. Kollman and Janica (1982) derived the transport equation for the probability density function of a scalar in turbulent shear flow and considered a closure model based on gradient-flux model. Kishore and Singh (1984) derived the transport equation for the bivariate joint distribution function of velocity and temperature in turbulent flow. Also Kishore and Singh (1985) have been derived the transport equation for the joint distribution function of velocity, temperature and concentration in convective turbulent flow. Dixit and Upadhyay (1989) considered the distribution functions in the statistical theory of MHD turbulence of an incompressible fluid in the presence of the coriolis force. Sarker and Kishore (1991) discussed the distribution functions in the statistical theory of convective MHD turbulence of an incompressible fluid. Also Sarker and Kishore (1999) studied the distribution functions in the statistical theory of convective MHD turbulence of mixture of a miscible incompressible fluid. In the continuation of the above researcher Sarker and Islam (2002) studied the Distribution functions in the statistical theory of convective MHD turbulence of an incompressible fluid in a rotating system. Azad and Sarker (2003) considered the decay of MHD turbulence before the final period for the case of multi-point and multi-time in presence of dust particle. Azad and Sarker (2004) discussed statistical theory of certain distribution functions in MHD turbulence in a rotating system in presence of dust particles. Islam and Sarker (2007) studied distribution functions in the statistical theory of MHD turbulence for velocity and concentration undergoing a first order reaction. Azad and Sarker

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(2009) had measured the decay of temperature fluctuations in MHD turbulence before the final period in a rotating system. Aziz *et al*. (2010a, b) and Azad *et al*. (2011) studied statistical theory of certain Distribution Functions in MHD turbulent flow undergoing a first order reaction in presence of dust particles and rotating system. Azad *et al*. (2012) derived the transport equatoin for the joint distribution function of velocity, temperature and concentration in convective tubulent flow in presence of dust particles. Recently Azad *et al*. (2013) further has been studied the transport equatoin for the joint distribution functions in convective tubulent flow in presence of dust particles undergoing a first order reaction. All of the above researchers had carried out their research for one and two point distribution functions.

The main purpose of this study is to study the statistical theory for three point distribution functions for simultaneous velocity, magnetic temperature and concentration fields in MHD turbulence. Finally, the transport equations for evolution of distribution functions have been derived and various properties of the distribution function have been discussed.

## MATERIALS AND METHODS

**Basic equations:** The equations of motion and continuity for viscous incompressible dusty fluid MHD turbulent flow, the diffusion equations for the temperature and concentration in a rotating system are given by:

$$\frac{\partial u_\alpha}{\partial t}+\frac{\partial}{\partial x_\beta}\left(u_\alpha u_\beta-h_\alpha h_\beta\right)=-\frac{\partial w}{\partial x_\alpha}+\nu\nabla^2 u_\alpha \tag{1}$$

$$\frac{\partial h_\alpha}{\partial t}+\frac{\partial}{\partial x_\beta}\left(h_\alpha u_\beta-u_\alpha h_\beta\right)=\lambda\nabla^2 h_\alpha \tag{2}$$

$$\frac{\partial \theta}{\partial t}+u_\beta\frac{\partial \theta}{\partial x_\beta}=\gamma\nabla^2\theta \tag{3}$$

$$\frac{\partial c}{\partial t}+u_\beta\frac{\partial c}{\partial x_\beta}=D\nabla^2 c \tag{4}$$

with $$\frac{\partial u_\alpha}{\partial x_\alpha}=\frac{\partial v_\alpha}{\partial x_\alpha}=\frac{\partial h_\alpha}{\partial x_\alpha}=0 \tag{5}$$

where,

$u_\alpha(x,t)$ = α-component of turbulent velocity
$h_\alpha(x,t)$ = α-component of magnetic field
$\theta(x,t)$ = Temperature fluctuation
C = Concentration of contaminants $w(\hat{x},t)=P/\rho+\frac{1}{2}\left|\vec{h}\right|^2+\frac{1}{2}\left|\hat{\Omega}\times\hat{x}\right|^2$, total pressure
$P(\hat{x},t)$ = Hydrodynamic pressure
ρ = Fluid density
ν = Kinetic viscosity
$\lambda=(4\pi\mu\sigma)^{-1}$ = Magnetic diffusivity
$\gamma=\frac{k_T}{\rho c_p}$ = Thermal diffusivity
$c_p$ = Specific heat at constant pressure
$k_T$ = Thermal conductivity
σ = Electrical conductivity
μ = Magnetic permeability
D = Diffusive co-efficient for contaminants

The repeated suffices are assumed over the values 1, 2 and 3 and unrepeated suffices may take any of these values. Here u, h and x are vector quantities in the whole process.

The total pressure w which, occurs in Eq. (1) may be eliminated with the help of the equation obtained by taking the divergence of Eq. (1):

$$\nabla^2 w = -\frac{\partial^2}{\partial x_\alpha \partial x_\beta}\left(u_\alpha u_\beta - h_\alpha h_\beta\right) = -\left[\ \frac{\partial u_\alpha}{\partial x_\beta}\frac{\partial u_\beta}{\partial x_\alpha} - \frac{\partial h_\alpha}{\partial x_\beta}\frac{\partial h_\beta}{\partial x_\alpha}\ \right] \tag{6}$$

In a conducting infinite fluid only the particular solution of the Eq. (6) is related, so that:

$$w = \frac{1}{4\pi}\int \left[\ \frac{\partial u'_\alpha}{\partial x'_\beta}\frac{\partial u'_\beta}{\partial x'_\alpha} - \frac{\partial h'_\alpha}{\partial x'_\beta}\frac{\partial h'_\beta}{\partial x'_\alpha}\ \right]\frac{\partial \bar{x}'}{\left|\bar{x}' - \bar{x}\right|} \tag{7}$$

Hence Eq. (1) to (4) becomes:

$$\frac{\partial u_\alpha}{\partial t} + \frac{\partial}{\partial x_\beta}\left(u_\alpha u_\beta - h_\alpha h_\beta\right) = -\frac{1}{4\pi}\frac{\partial}{\partial x_\alpha}\int \left[\ \frac{\partial u'_\alpha}{\partial x'_\beta}\frac{\partial u'_\beta}{\partial x'_\alpha} - \frac{\partial h'_\alpha}{\partial x'_\beta}\frac{\partial h'_\beta}{\partial x'_\alpha}\ \right]\frac{d\bar{x}'}{\left|\bar{x}' - \bar{x}\right|} + \nu\nabla^2 u_\alpha \tag{8}$$

$$\frac{\partial h_\alpha}{\partial t} + \frac{\partial}{\partial x_\beta}\left(h_\alpha u_\beta - u_\alpha h_\beta\right) = \lambda\nabla^2 h_\alpha \tag{9}$$

$$\frac{\partial \theta}{\partial t} + u_\beta\frac{\partial \theta}{\partial x_\beta} = \gamma\nabla^2\theta \tag{10}$$

$$\frac{\partial c}{\partial t} + u_\beta\frac{\partial c}{\partial x_\beta} = D\nabla^2 c \tag{11}$$

## FORMULATION OF THE PROBLEM

The researchers consider the turbulence and the concentration fields are homogeneous, the chemical reaction and the local mass transfer have no effect on the velocity field and the reaction rate and the diffusivity are constant. They also consider a large ensemble of identical fluids in which each member is an infinite incompressible reacting and heat conducting fluid in turbulent state. The fluid velocity u, Alfven velocity h, temperature θ and concentration C are randomly distributed functions of position and time and satisfy their field. Different members of ensemble are subjected to different initial conditions and the aim is to find out a way by which we can determine the ensemble averages at the initial time.

Certain microscopic properties of conducting fluids such as total energy, total pressure, stress tensor which are nothing but ensemble averages at a particular time can be determined with the help of the bivariate distribution functions (defined as the averaged distribution functions with the help of Dirac delta-functions). The present aim is to construct the distribution functions, study its properties and derive an equation for its evolution of this distribution functions.

**Distribution function in MHD turbulence and their properties:** In MHD turbulence, we may consider the fluid velocity u, Alfven velocity h, temperature θ and concentration c at each point of the flow field. Then corresponding to each point of the flow field, we have four measurable characteristics. We represent the four variables by v, g, $\phi$ and ψ and denote the pairs of the several variables at the points:

$$\bar{x}^{(1)}, \bar{x}^{(2)}, -----, \bar{x}^{(n)} \text{ as } \left(\bar{v}^{(1)}, \bar{g}^{(1)}, \phi^{(1)}, \psi^{(1)}\right), \left(\bar{v}^{(2)}, \bar{g}^{(2)}, \phi^{(2)}, \psi^{(2)}\right), \ldots\ldots\ldots\ldots, \left(\bar{v}^{(n)}, \bar{g}^{(n)}, \phi^{(n)}, \psi^{(n)}\right)$$

at a fixed instant of time.

It is possible that the same pair may be occur more than once; therefore, we simplify the problem by an assumption that the distribution is discrete (in the sense that no pairs occur more than once). Symbolically we can express the bivariate distribution as:

$$\left\{\ \left(\bar{v}^{(1)}, \bar{g}^{(1)}, \phi^{(1)}, \psi^{(1)}\right), \left(\bar{v}^{(2)}, \bar{g}^{(2)}, \phi^{(2)}, \psi^{(2)}\right), ------ \left(\bar{v}^{(n)}, \bar{g}^{(n)}, \phi^{(n)}, \psi^{(n)}\right)\ \right\}$$

Instead of considering discrete points in the flow field, if we consider the continuous distribution of the variables $\bar{v}, \bar{g}, \phi$ and ψ over the entire flow field, statistically behavior of the fluid may be described by the distribution function $F\left(\bar{v}, \bar{g}, \phi, \psi\right)$ which is normalized so that:

$$\int F\left(\bar{v},\bar{g},\phi,\psi\right)d\bar{v}\,d\bar{g}\,d\phi\,d\psi = 1$$

where, the integration ranges over all the possible values of v, g, $\phi$ and $\psi$. We shall make use of the same normalization condition for the discrete distributions also.
The distribution functions of the above quantities can be defined in terms of Dirac delta function.

The one-point distribution function $F_1^{(1)}\left(v^{(1)},g^{(1)},\phi^{(1)},\psi^{(1)}\right)$, defined so that $F_1^{(1)}\left(v^{(1)},g^{(1)},\phi^{(1)},\psi^{(1)}\right)dv^{(1)}dg^{(1)}d\phi^{(1)}d\psi^{(1)}$ is the probability that the fluid velocity, Alfven velocity, temperature and concentration at a time t are in the element $dv^{(1)}$ about $v^{(1)}$, $dg^{(1)}$ about $g^{(1)}$, $d\phi^{(1)}$ about $\phi^{(1)}$ and $d\psi^{(1)}$ about $\psi^{(1)}$ respectively and is given by:

$$F_1^{(1)}\left(v^{(1)},g^{(1)},\phi^{(1)},\psi^{(1)}\right)=\left\langle \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\right\rangle \tag{12}$$

where $\delta$ is the Dirac delta-function defined as:

$$\int \delta\left(\bar{u}-\bar{v}\right)d\bar{v} = \begin{cases} 1 & \text{at the point } \bar{u}=\bar{v} \\ 0 & \text{elsewhere} \end{cases}$$

Two-point distribution function is given by:

$$\begin{aligned} F_2^{(1,2)} = \Big\langle &\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\\ &\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)\Big\rangle \end{aligned} \tag{13}$$

And three point distribution function is given by:

$$\begin{aligned} F_3^{(1,2,3)} = \Big\langle &\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\\ \times &\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\Big\rangle \end{aligned} \tag{14}$$

Similarly, we can define an infinite numbers of multi-point distribution functions $F_4^{(1,2,3,4)}$, $F_5^{(1,2,3,4,5)}$ and so on. The following properties of the constructed distribution functions can be deduced from the above definitions:

**Reduction properties:** Integration with respect to pair of variables at one-point, lowers the order of distribution function by one. For example:

$$\int F_1^{(1)}dv^{(1)}dg^{(1)}d\phi^{(1)}d\psi^{(1)} = 1$$
$$\int F_2^{(1,2)}dv^{(2)}dg^{(2)}d\phi^{(2)}d\psi^{(2)} = F_1^{(1)}$$
$$\int F_3^{(1,2,3)}dv^{(3)}dg^{(3)}d\phi^{(3)}d\psi^{(3)} = F_2^{(1,2)}$$

and so on. Also the integration with respect to any one of the variables, reduces the number of Delta-functions from the distribution function by one as:

$$\int F_1^{(1)}dv^{(1)} = \left\langle \delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\right\rangle$$
$$\int F_1^{(1)}dg^{(1)} = \left\langle \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\right\rangle$$
$$\int F_1^{(1)}d\phi^{(1)} = \left\langle \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\right\rangle$$

and,

$$\int F_2^{(1,2)}dv^{(2)} = \left\langle \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)\right\rangle$$

**Separation properties:** If two points are far apart from each other in the flow field, the pairs of variables at these points are statistically independent of each other i.e.:

$$\lim \left|\vec{x}^{(2)} \to \vec{x}^{(1)}\right| \to \infty \quad F_2^{(1,2)} = F_1^{(1)} F_1^{(2)}$$

and similarly, $\lim \left|\vec{x}^{(3)} \to \vec{x}^{(2)}\right| \to \infty \quad F_3^{(1,2,3)} = F_2^{(1,2)} F_1^{(3)}$ etc

**Co-incidence property:** When two points coincide in the flow field, the components at these points should be obviously the same that is $F_2^{(1,2)}$ must be zero. Thus $\bar{v}^{(2)} = \bar{v}^{(1)}$, $g^{(2)} = g^{(1)}$, $\phi^{(2)} = \phi^{(1)}$ and $\psi^{(2)} = \psi^{(1)}$, but $F_2^{(1,2)}$ must also have the property:

$$\int F_2^{(1,2)} dv^{(2)} dg^{(2)} d\phi^{(2)} d\psi^{(2)} = F_1^{(1)}$$

And hence it follows that:

$$\lim\left|\vec{x}^{(2)} \to \vec{x}^{(1)}\right| \to \infty \int \; F_2^{(1,2)} = F_1^{(1)} \delta\left(v^{(2)} - v^{(1)}\right) \delta\left(g^{(2)} - g^{(1)}\right) \delta\left(\phi^{(2)} - \phi^{(1)}\right) \delta\left(\psi^{(2)} - \psi^{(1)}\right)$$

Similarly:

$$\lim\left|\vec{x}^{(3)} \to \vec{x}^{(2)}\right| \to \infty \int \; F_3^{(1,2,3)} = F_2^{(1,2)} \delta\left(v^{(3)} - v^{(1)}\right) \delta\left(g^{(3)} - g^{(1)}\right) \delta\left(\phi^{(3)} - \phi^{(1)}\right) \delta\left(\psi^{(3)} - \psi^{(1)}\right) \text{ etc}$$

**Symmetric conditions:**

$$F_n^{(1,2,r,------s,-----n)} = F_n^{(1,2,-----s,---r,---n)}$$

**Incompressibility conditions:**

- $$\int \frac{\partial F_n^{(1,2,---n)}}{\partial x_\alpha^{(r)}} v_\alpha^{(r)} d\bar{v}^{(r)} d\bar{h}^{(r)} = 0$$
- $$\int \frac{\partial F_n^{(1,2,---n)}}{\partial x_\alpha^{(r)}} h_\alpha^{(r)} d\bar{v}^{(r)} d\bar{h}^{(r)} = 0$$

**Continuity equation in terms of distribution functions:** The continuity equations can be easily expressed in terms of distribution functions. An infinite number of continuity equations can be derived for the convective MHD turbulent flow and are obtained directly by using div $u = 0$

Taking ensemble average of Eq. (15), we get:

$$0 = \left\langle \frac{\partial u_\alpha^{(1)}}{\partial x_\alpha^{(1)}} \right\rangle = \left\langle \; \frac{\partial}{\partial x_\alpha^{(1)}} u_\alpha^{(1)} \int F_1^{(1)} dv^{(1)} dg^{(1)} d\phi^{(1)} d\psi^{(1)} \; \right\rangle$$

$$= \frac{\partial}{\partial x_\alpha^{(1)}} \left\langle \; u_\alpha^{(1)} \int F_1^{(1)} dv^{(1)} dg^{(1)} d\phi^{(1)} d\psi^{(1)} \; \right\rangle$$

$$= \frac{\partial}{\partial x_\alpha^{(1)}} \int \; \left\langle \; u_\alpha^{(1)} \; \right\rangle \left\langle \; F_1^{(1)} \; \right\rangle dv^{(1)} dg^{(1)} d\phi^{(1)} d\psi^{(1)}$$

$$= \frac{\partial}{\partial x_\alpha^{(1)}} \int \; v_\alpha^{(1)} F_1^{(1)} dv^{(1)} dg^{(1)} d\phi^{(1)} d\psi^{(1)}$$

$$= \int \frac{\partial F_1^{(1)}}{\partial x_\alpha^{(1)}} v_\alpha^{(1)} dv^{(1)} dg^{(1)} d\phi^{(1)} d\psi^{(1)} \tag{15}$$

And similarly:

$$0 = \int \frac{\partial F_1^{(1)}}{\partial x_\alpha^{(1)}} g_\alpha^{(1)} dv^{(1)} dg^{(1)} d\phi^{(1)} d\psi^{(1)} \tag{16}$$

Which are the first order continuity equations in which only one point distribution function is involved.

For second-order continuity equations, if we multiply the continuity equation by $\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$ and if we take the ensemble average, we obtain:

$$o = \left\langle \delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)\frac{\partial u_\alpha^{(1)}}{\partial x_\alpha^{(1)}} \right\rangle$$

$$= \frac{\partial}{\partial x_\alpha^{(1)}} \left\langle \delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)u_\alpha^{(1)} \right\rangle$$

$$= \frac{\partial}{\partial x_\alpha^{(1)}} \left[ \int \left\langle u_\alpha^{(1)} \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right) \right.\right.$$

$$\left.\left. \times \delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right) \right\rangle dv^{(1)} dg^{(1)} d\phi^{(1)} d\psi^{(1)} \right]$$

$$= \frac{\partial}{\partial x_\alpha^{(1)}} \int v_\alpha^{(1)} F_2^{(1,2)} dv^{(1)} dg^{(1)} d\phi^{(1)} d\psi^{(1)} \tag{17}$$

and similarly:

$$o = \frac{\partial}{\partial x_\alpha^{(1)}} \int g_\alpha^{(1)} F_2^{(1,2)} dv^{(1)} dg^{(1)} d\phi^{(1)} d\psi^{(1)} \tag{18}$$

The Nth-order continuity equations are:

$$o = \frac{\partial}{\partial x_\alpha^{(1)}} \int v_\alpha^{(1)} F_N^{(1,2,---,N)} dv^{(1)} dg^{(1)} d\phi^{(1)} d\psi^{(1)} \tag{19}$$

and,

$$o = \frac{\partial}{\partial x_\alpha^{(1)}} \int g_\alpha^{(1)} F_N^{(1,2,.........,N)} dv^{(1)} dg^{(1)} d\phi^{(1)} d\psi^{(1)} \tag{20}$$

The continuity equations are symmetric in their arguments i.e.:

$$\frac{\partial}{\partial x_\alpha^{(r)}} \left( v_\alpha^{(r)} F_N^{(1,2,..........;r.N)} dv^{(r)} dg^{(r)} d\phi^{(r)} d\psi^{(r)} \right) = \frac{\partial}{\partial x_\alpha^{(s)}} \int v_\alpha^{(s)} F_N^{(1,2,.....r,s,.....N)} dv^{(s)} dg^{(s)} d\phi^{(s)} d\psi^{(s)} \tag{21}$$

Since the divergence property is an important property and it is easily verified by the use of the property of distribution function as:

$$\frac{\partial}{\partial x_\alpha^{(1)}} \int v_\alpha^{(1)} F_1^{(1)} dv^{(1)} dg^{(1)} d\phi^{(1)} d\psi^{(1)} \frac{\partial}{\partial x_\alpha^{(1)}} \left\langle u_\alpha^{(1)} \right\rangle = \left\langle \frac{\partial u_\alpha^{(1)}}{\partial x_\alpha^{(1)}} \right\rangle = o \tag{22}$$

And all the properties of the distribution function obtained in section (Distribution function in MHD turbulence and their properties) can also be verified.

**Equations for one-point distribution functions $F_1^{(1)}$:** We shall use of Eq. (8) to (11) and convert to these into a set of equations for the variation of the distribution function with time. This, in fact, is done by making use of the definitions of the constructed distribution functions, differentiating them partially with respect to time, making some suitable operations on the right-hand side of the equation so obtained and lastly replacing the time derivative of $u$, $h$, $\theta$ and c from the Eq. (8) to (11).
Differentiating Eq. (12) with respect to time, we get:

$$
\begin{aligned}
\frac{\partial F_1^{(1)}}{\partial t} &= \frac{\partial}{\partial t}\left\langle \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\right\rangle \\
&= \left\langle \delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\frac{\partial}{\partial t}\delta\left(u^{(1)}-v^{(1)}\right)\right\rangle \\
&+ \left\langle \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\frac{\partial}{\partial t}\delta\left(h^{(1)}-g^{(1)}\right)\right\rangle \\
&+ \left\langle \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\frac{\partial}{\partial t}\delta\left(\theta^{(1)}-\phi^{(1)}\right)\right\rangle \\
&+ \left\langle \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\frac{\partial}{\partial t}\delta\left(c^{(1)}-\psi^{(1)}\right)\right\rangle \\
&= \left\langle -\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\frac{\partial u^{(1)}}{\partial t}\frac{\partial}{\partial v^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\right\rangle \\
&+ \left\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\frac{\partial h^{(1)}}{\partial t}\frac{\partial}{\partial g^{(1)}}\delta\left(h^{(1)}-g^{(1)}\right)\right\rangle \\
&+ \left\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\frac{\partial \theta^{(1)}}{\partial t}\frac{\partial}{\partial \phi^{(1)}}\delta\left(\theta^{(1)}-\phi^{(1)}\right)\right\rangle \\
&+ \left\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\frac{\partial c^{(1)}}{\partial t}\frac{\partial}{\partial \psi^{(1)}}\delta\left(c^{(1)}-\psi^{(1)}\right)\right\rangle
\end{aligned} \tag{23}
$$

Using Eq. (8) to (11) in the Eq. (23), we get:

$$
\begin{aligned}
\frac{\partial F_1^{(1)}}{\partial t} &= \Bigg\langle -\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\Bigg\{ -\frac{\partial}{\partial x_\beta^{(1)}}\left(u_\alpha^{(1)}u_\beta^{(1)}-h_\alpha^{(1)}h_\beta^{(1)}\right) \\
&-\frac{1}{4\pi}\frac{\partial}{\partial x_\alpha^{(1)}}\int\left[\frac{\partial u_\alpha^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial u_\beta^{(1)}}{\partial x_\alpha^{(1)}}-\frac{\partial h_\alpha^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial h_\beta^{(1)}}{\partial x_\alpha^{(1)}}\right]\frac{d\bar{x}'}{|\bar{x}'-\bar{x}|}+\nu\nabla^2u_\alpha^{(1)}\Bigg\} \\
&\times\frac{\partial}{\partial v_\alpha^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\Bigg\rangle + \Big\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right) \\
&\left\{ -\frac{\partial}{\partial x_\beta^{(1)}}\left(h_\alpha^{(1)}u_\beta^{(1)}-u_\alpha^{(1)}h_\beta^{(1)}\right)+\lambda\nabla^2h_\alpha^{(1)}\right\}\times\frac{\partial}{\partial g_\alpha^{(1)}}\delta\left(h^{(1)}-g^{(1)}\right)\Big\rangle \\
&+\Big\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\left\{-u_\beta^{(1)}\frac{\partial\theta^{(1)}}{\partial x_\beta^{(1)}}+\gamma\nabla^2\theta^{(1)}\right\} \\
&\times\frac{\partial}{\partial\phi^{(1)}}\delta\left(\theta^{(1)}-\phi^{(1)}\right)\Big\rangle+\Big\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\left\{-u_\beta^{(1)}\frac{\partial c^{(1)}}{\partial x_\beta^{(1)}}+D\nabla^2c\right\} \\
&\times\frac{\partial}{\partial\psi^{(1)}}\delta\left(c^{(1)}-\psi^{(1)}\right)\Big\rangle
\end{aligned}
$$

$$=\left\langle \delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\frac{\partial u_\alpha^{(1)}u_\beta^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial v_\alpha^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\right\rangle$$
$$+\left\langle -\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\frac{\partial h_\alpha^{(1)}h_\beta^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial v_\alpha^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\right.$$
$$+\left\langle \delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\frac{1}{4\pi}\frac{\partial}{\partial x_\alpha^{(1)}}\int\left[\frac{\partial u_\alpha^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial u_\beta^{(1)}}{\partial x_\alpha^{(1)}}-\frac{\partial h_\alpha^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial h_\beta^{(1)}}{\partial x_\alpha^{(1)}}\right]\right.$$
$$\times\frac{d\bar{x}'}{\left|\bar{x}'-\bar{x}\right|}\frac{\partial}{\partial v_\alpha^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\Bigg\rangle+\left\langle -\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\times\nu\nabla^2 u_\alpha^{(1)}\frac{\partial}{\partial v_\alpha^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\right\rangle$$
$$+\left\langle \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\times\frac{\partial h_\alpha^{(1)}u_\beta^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial g_\alpha^{(1)}}\delta\left(h^{(1)}-g^{(1)}\right)\right\rangle$$
$$+\left\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\times\frac{\partial u_\alpha^{(1)}h_\beta^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial g_\alpha^{(1)}}\delta\left(h^{(1)}-g^{(1)}\right)\right\rangle$$
$$+\left\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\times\lambda\nabla^2 h_\alpha^{(1)}\frac{\partial}{\partial g_\alpha^{(1)}}\delta\left(h^{(1)}-g^{(1)}\right)\right\rangle$$
$$+\left\langle \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\times u_\beta^{(1)}\frac{\partial\theta^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial\phi^{(1)}}\delta\left(\theta^{(1)}-\phi^{(1)}\right)\right\rangle$$
$$+\left\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\times\gamma\nabla^2\theta^{(1)}\frac{\partial}{\partial\phi^{(1)}}\delta\left(\theta^{(1)}-\phi^{(1)}\right)\right\rangle$$
$$+\left\langle \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\times u_\beta^{(1)}\frac{\partial c^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial\psi^{(1)}}\delta\left(c^{(1)}-\psi^{(1)}\right)\right\rangle$$
$$+\left\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\times D\nabla^2 c^{(1)}\frac{\partial}{\partial\psi^{(1)}}\delta\left(c^{(1)}-\psi^{(1)}\right)\right\rangle \tag{24}$$

Various terms in the above equation can be simplified as that they may be expressed in terms of one point and two point distribution functions.

The 1st term in the Eq. (24) is simplified as follows:

$$\left\langle \delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\frac{\partial u_\alpha^{(1)}u_\beta^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial v_\alpha^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\right\rangle$$
$$=\left\langle u_\beta^{(1)}\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\frac{\partial u_\alpha^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial v_\alpha^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\right\rangle$$
$$=\left\langle -u_\beta^{(1)}\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\frac{\partial u_\alpha^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial x_\beta^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\right\rangle$$
$$=\left\langle -u_\beta^{(1)}\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\frac{\partial}{\partial x_\beta^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\right\rangle;\ (\text{since}\ \frac{\partial u_\alpha^{(1)}}{\partial v_\alpha^{(1)}}=1)$$
$$=\left\langle -\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)u_\beta^{(1)}\frac{\partial}{\partial x_\beta^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\right\rangle \tag{25}$$

Similarly, fifth, eight and tenth terms of right hand-side of Eq. (24) can be simplified as follows:

$$\left\langle \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\frac{\partial h_\alpha^{(1)}u_\beta^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial g_\alpha^{(1)}}\delta\left(h^{(1)}-g^{(1)}\right)\right\rangle$$
$$=\left\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)u_\beta^{(1)}\frac{\partial}{\partial x_\beta^{(1)}}\delta\left(h^{(1)}-g^{(1)}\right)\right\rangle \tag{26}$$

Eight term:

$$\left\langle \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)u_{\beta}^{(1)}\frac{\partial\theta^{(1)}}{\partial x_{\beta}^{(1)}}\frac{\partial}{\partial\phi^{(1)}}\delta\left(\theta^{(1)}-\phi^{(1)}\right)\right\rangle$$
$$=\left\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)u_{\beta}^{(1)}\frac{\partial}{\partial x_{\beta}^{(1)}}\delta\left(\theta^{(1)}-\phi^{(1)}\right)\right\rangle \tag{27}$$

and tenth term:

$$\left\langle \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)u_{\beta}^{(1)}\frac{\partial c^{(1)}}{\partial x_{\beta}^{(1)}}\frac{\partial}{\partial\psi^{(1)}}\delta\left(c^{(1)}-\psi^{(1)}\right)\right\rangle$$
$$=\left\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)u_{\beta}^{(1)}\frac{\partial}{\partial x_{\beta}^{(1)}}\delta\left(c^{(1)}-\psi^{(1)}\right)\right\rangle \tag{28}$$

Adding these equations from (25) to (28), we get:

$$\left\langle -\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)u_{\beta}^{(1)}\frac{\partial}{\partial x_{\beta}^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\right\rangle$$
$$+\left\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)u_{\beta}^{(1)}\frac{\partial}{\partial x_{\beta}^{(1)}}\delta\left(h^{(1)}-g^{(1)}\right)\right\rangle$$
$$+\left\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)u_{\beta}^{(1)}\frac{\partial}{\partial x_{\beta}^{(1)}}\delta\left(\theta^{(1)}-\phi^{(1)}\right)\right\rangle$$
$$+\left\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)u_{\beta}^{(1)}\frac{\partial}{\partial x_{\beta}^{(1)}}\delta\left(c^{(1)}-\psi^{(1)}\right)\right\rangle$$
$$=-\frac{\partial}{\partial x_{\beta}^{(1)}}\left\langle u_{\beta}^{(1)}\left\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\right\rangle\right.$$
$$=-\frac{\partial}{\partial x_{\beta}^{(1)}}v_{\beta}^{(1)}F_{1}^{(1)}\ \text{(Applying the properties of distribution functions)}$$
$$=-v_{\beta}^{(1)}\frac{\partial F_{1}^{(1)}}{\partial x_{\beta}^{(1)}} \tag{29}$$

Similarly second and sixth terms on the right hand-side of the Eq. (24) can be simplified as:

$$\left\langle -\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\frac{\partial h_{\alpha}^{(1)}h_{\beta}^{(1)}}{\partial x_{\beta}^{(1)}}\frac{\partial}{\partial v_{\alpha}^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\right\rangle=-g_{\beta}^{(1)}\frac{\partial g_{\alpha}^{(1)}}{\partial v_{\alpha}^{(1)}}\frac{\partial}{\partial x_{\beta}^{(1)}}F_{1}^{(1)} \tag{30}$$

and,

$$\left\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\frac{\partial u_{\alpha}^{(1)}h_{\beta}^{(1)}}{\partial x_{\beta}^{(1)}}\frac{\partial}{\partial g_{\alpha}}\delta\left(h^{(1)}-g^{(1)}\right)\right\rangle$$

$$=-g_{\beta}^{(1)}\frac{\partial v_{\alpha}^{(1)}}{\partial g_{\alpha}^{(1)}}\frac{\partial}{\partial x_{\beta}^{(1)}}F_{1}^{(1)} \tag{31}$$

**Fourth term can be reduced as:**

$$
\begin{aligned}
&\left\langle -\nu\nabla^2 u_\alpha^{(1)}\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\frac{\partial}{\partial v_\alpha^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\right.\\
&=-\nu\frac{\partial}{\partial v_\alpha^{(1)}}\left\langle \nabla^2 u_\alpha^{(1)}\left[\ \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\ \right]\right\rangle\\
&=-\nu\frac{\partial}{\partial v_\alpha^{(1)}}\frac{\partial^2}{\partial x_\beta^{(1)}\partial x_\beta^{(1)}}\left\langle u_\alpha^{(1)}\left[\ \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\ \right]\right\rangle\\
&=-\nu\frac{\partial}{\partial v_\alpha^{(1)}}\lim_{\bar{x}^{(2)}\to\bar{x}^{(1)}}\frac{\partial^2}{\partial x_\beta^{(2)}\partial x_\beta^{(2)}}\left\langle u_\alpha^{(2)}\left[\ \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\ \right]\right\rangle\\
&=-\nu\frac{\partial}{\partial v_\alpha^{(1)}}\lim_{\bar{x}^{(2)}\to\bar{x}^{(1)}}\frac{\partial^2}{\partial x_\beta^{(2)}\partial x_\beta^{(2)}}\left\langle\int\ u_\alpha^{(2)}\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)\right.\\
&\times\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)dv^{(2)}dg^{(2)}d\phi^{(2)}d\psi^{(2)}\\
&=-\nu\frac{\partial}{\partial v_\alpha^{(1)}}\lim_{\bar{x}^{(2)}\to\bar{x}^{(1)}}\frac{\partial^2}{\partial x_\beta^{(2)}\partial x_\beta^{(2)}}\int v_\alpha^{(2)}F_2^{(1,2)}dv^{(2)}dg^{(2)}d\phi^{(2)}d\psi^{(2)}
\end{aligned}
\tag{32}
$$

Seven, nine and eleventh terms of the right hand side of Eq. (24):

$$
\begin{aligned}
&\left\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\lambda\nabla^2 h_\alpha^{(1)}\frac{\partial}{\partial g_\alpha^{(1)}}\delta\left(h^{(1)}-g^{(1)}\right)\right\rangle\\
&=\left\langle -\lambda\nabla^2 h_\alpha^{(1)}\frac{\partial}{\partial g_\alpha^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\right\rangle\\
&=-\lambda\frac{\partial}{\partial g_\alpha^{(1)}}\lim_{\bar{x}^{(2)}\to\bar{x}^{(1)}}\frac{\partial^2}{\partial x_\beta^{(2)}\partial x_\beta^{(2)}}\int g_\alpha^{(2)}F_2^{(1,2)}dv^{(2)}dg^{(2)}d\phi^{(2)}d\psi^{(2)}
\end{aligned}
\tag{33}
$$

Ninth term:

$$
\begin{aligned}
&\left\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\gamma\nabla^2\theta^{(1)}\frac{\partial}{\partial\phi^{(1)}}\delta\left(\theta^{(1)}-\phi^{(1)}\right)\right\rangle\\
&=\left\langle -\gamma\nabla^2\theta^{(1)}\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\frac{\partial}{\partial\phi^{(1)}}\delta\left(\theta^{(1)}-\phi^{(1)}\right)\right\rangle\\
&=-\gamma\frac{\partial}{\partial\phi^{(1)}}\lim_{\bar{x}^{(2)}\to\bar{x}^{(1)}}\frac{\partial^2}{\partial x_\beta^{(2)}\partial x_\beta^{(2)}}\int\phi^{(2)}F_2^{(1,2)}dv^{(2)}dg^{(2)}d\phi^{(2)}d\psi^{(2)}
\end{aligned}
\tag{34}
$$

Eleventh term:

$$
\begin{aligned}
&\left\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)D\nabla^2 c^{(1)}\frac{\partial}{\partial\psi^{(1)}}\delta\left(c^{(1)}-\psi^{(1)}\right)\right\rangle\\
&=\left\langle -D\nabla^2 c^{(1)}\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\frac{\partial}{\partial\phi^{(1)}}\delta\left(\theta^{(1)}-\phi^{(1)}\right)\right\rangle\\
&=-D\frac{\partial}{\partial\psi^{(1)}}\lim_{\bar{x}^{(2)}\to\bar{x}^{(1)}}\frac{\partial^2}{\partial x_\beta^{(2)}\partial x_\beta^{(2)}}\int\psi^{(2)}F_2^{(1,2)}dv^{(2)}dg^{(2)}d\phi^{(2)}d\psi^{(2)}
\end{aligned}
\tag{35}
$$

We reduce the third term of right hand side of Eq. (24), we get:

$$\left\langle \delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\frac{1}{4\pi}\frac{\partial}{\partial x_\alpha^{(1)}}\int\left[\frac{\partial u_\alpha^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial u_\beta^{(1)}}{\partial x_\alpha^{(1)}}-\frac{\partial h_\alpha^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial h_\beta^{(1)}}{\partial x_\alpha^{(1)}}\right]\frac{d\overline{x}'}{\left|\overline{x}'-\overline{x}\right|}\frac{\partial}{\partial v_\alpha^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\right\rangle$$

$$=\frac{\partial}{\partial v_\alpha^{(1)}}\left[\frac{1}{4\pi}\int\frac{\partial}{\partial x_\alpha^{(1)}}\left(\frac{1}{\left|\overline{x}^{(2)}-\overline{x}^{(1)}\right|}\right)\left(\frac{\partial v_\alpha^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial v_\beta^{(2)}}{\partial x_\alpha^{(2)}}-\frac{\partial g_\alpha^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial g_\beta^{(2)}}{\partial x_\alpha^{(2)}}\right)F_2^{(1,2)}dx^{(2)}dv^{(2)}dg^{(2)}d\phi^{(2)}d\psi^{(2)}\right] \tag{36}$$

Substituting the results (25) to (36) in Eq. (24), we get the transport equation for one point distribution function $F_1^{(1)}(v,g,\phi,\psi)$ in MHD turbulent flow as:

$$\frac{\partial F_1^{(1)}}{\partial t}+v_\beta^{(1)}\frac{\partial F_1^{(1)}}{\partial x_\beta^{(1)}}+g_\beta^{(1)}\left(\frac{\partial g_\alpha^{(1)}}{\partial v_\alpha^{(1)}}+\frac{\partial v_\alpha^{(1)}}{\partial g_\alpha^{(1)}}\right)\frac{\partial F_1^{(1)}}{\partial x_\beta^{(1)}}-\frac{\partial}{\partial v_\alpha^{(1)}}\left[\frac{1}{4\pi}\int\frac{\partial}{\partial x_\alpha^{(1)}}\left(\frac{1}{\left|\overline{x}^{(2)}-\overline{x}^{(1)}\right|}\right)\right.$$

$$\left.\times\left(\frac{\partial v_\alpha^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial v_\beta^{(2)}}{\partial x_\alpha^{(2)}}-\frac{\partial g_\alpha^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial g_\beta^{(2)}}{\partial x_\alpha^{(2)}}\right)F_2^{(1,2)}dx^{(2)}dv^{(2)}dg^{(2)}d\phi^{(2)}d\psi^{(2)}\right]$$

$$+\nu\frac{\partial}{\partial v_\alpha^{(1)}}\lim_{\overline{x}^{(2)}\to\overline{x}^{(1)}}\frac{\partial^2}{\partial x_\beta^{(2)}\partial x_\beta^{(2)}}\int v_\alpha^{(2)}F_2^{(1,2)}dv^{(2)}dg^{(2)}d\phi^{(2)}d\psi^{(2)}$$

$$+\lambda\frac{\partial}{\partial g_\alpha^{(1)}}\lim_{\overline{x}^{(2)}\to\overline{x}^{(1)}}\frac{\partial^2}{\partial x_\beta^{(2)}\partial x_\beta^{(2)}}\int g_\alpha^{(2)}F_2^{(1,2)}dv^{(2)}dg^{(2)}d\phi^{(2)}d\psi^{(2)}$$

$$+\gamma\frac{\partial}{\partial \phi^{(1)}}\lim_{\overline{x}^{(2)}\to\overline{x}^{(1)}}\frac{\partial^2}{\partial x_\beta^{(2)}\partial x_\beta^{(2)}}\int \phi^{(2)}F_2^{(1,2)}dv^{(2)}dg^{(2)}d\phi^{(2)}d\psi^{(2)}$$

$$+D\frac{\partial}{\partial \psi^{(1)}}\lim_{\overline{x}^{(2)}\to\overline{x}^{(1)}}\frac{\partial^2}{\partial x_\beta^{(2)}\partial x_\beta^{(2)}}\int \psi^{(2)}F_2^{(1,2)}dv^{(2)}dg^{(2)}d\phi^{(2)}d\psi^{(2)}=0 \tag{37}$$

**Equations for two-point distribution function $\boldsymbol{F_2^{(1,2)}}$:** Differentiating Eq. (13) partially with respect to time, making some suitable operations on the right-hand side of the equation so obtained and lastly replacing the time derivative of $u,h,\theta$ and c from the Eq. (8) to (11):

$$\frac{\partial F_2^{(1,2)}}{\partial t}=\frac{\partial}{\partial t}\left\langle \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\right.$$
$$\left.\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)\right\rangle$$
$$=\left\langle \delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\right.$$
$$\left.\delta\left(c^{(2)}-\psi^{(2)}\right)\frac{\partial}{\partial t}\delta\left(u^{(1)}-v^{(1)}\right)\right\rangle+\left\langle \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\right.$$
$$\left.\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)\frac{\partial}{\partial t}\delta\left(c^{(1)}-\psi^{(1)}\right)\right\rangle$$
$$+\left\langle \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\right.$$
$$\left.\delta\left(c^{(2)}-\psi^{(2)}\right)\frac{\partial}{\partial t}\delta\left(u^{(2)}-v^{(2)}\right)\right\rangle+\left\langle \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\right.$$
$$\left.\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)\frac{\partial}{\partial t}\delta\left(h^{(2)}-g^{(2)}\right)\right\rangle$$
$$+\left\langle \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\right.$$
$$\left.\delta\left(c^{(2)}-\psi^{(2)}\right)\frac{\partial}{\partial t}\delta\left(\theta^{(2)}-\phi^{(2)}\right)\right\rangle+\left\langle \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\right.$$
$$\left.\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\frac{\partial}{\partial t}\delta\left(c^{(2)}-\psi^{(2)}\right)\right\rangle$$

$$+\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$

$$\delta\left(c^{(2)}-\psi^{(2)}\right)\frac{\partial h^{(1)}}{\partial t}\frac{\partial}{\partial g^{(1)}}\delta\left(h^{(1)}-g^{(1)}\right)\rangle$$

$$=\langle -\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$

$$\delta\left(c^{(2)}-\psi^{(2)}\right)\frac{\partial u^{(1)}}{\partial t}\frac{\partial}{\partial v^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\rangle$$

$$+\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$

$$\delta\left(c^{(2)}-\psi^{(2)}\right)\frac{\partial \theta^{(1)}}{\partial t}\frac{\partial}{\partial \phi^{(1)}}\delta\left(\theta^{(1)}-\phi^{(1)}\right)\rangle$$

$$+\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$

$$\delta\left(c^{(2)}-\psi^{(2)}\right)\frac{\partial c^{(1)}}{\partial t}\frac{\partial}{\partial \psi^{(1)}}\delta\left(c^{(1)}-\psi^{(1)}\right)\rangle$$

$$+\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$

$$\delta\left(c^{(2)}-\psi^{(2)}\right)\frac{\partial u^{(2)}}{\partial t}\frac{\partial}{\partial v^{(2)}}\delta\left(u^{(2)}-v^{(2)}\right)\rangle$$

$$+\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$

$$\delta\left(c^{(2)}-\psi^{(2)}\right)\frac{\partial h^{(2)}}{\partial t}\frac{\partial}{\partial g^{(2)}}\delta\left(h^{(2)}-g^{(2)}\right)\rangle$$

$$+\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)$$

$$\delta\left(c^{(2)}-\psi^{(2)}\right)\frac{\partial \theta^{(2)}}{\partial t}\frac{\partial}{\partial \phi^{(2)}}\delta\left(\theta^{(2)}-\phi^{(2)}\right)\rangle$$

$$+\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)$$

$$\delta\left(\theta^{(2)}-\phi^{(2)}\right)\frac{\partial c^{(2)}}{\partial t}\frac{\partial}{\partial \psi^{(2)}}\delta\left(c^{(2)}-\psi^{(2)}\right)\rangle$$

Using Eq. (8) to (11), we get:

$$=\langle -\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$

$$\delta\left(c^{(2)}-\psi^{(2)}\right)\Big\{-\frac{\partial}{\partial x_\beta^{(1)}}\left(u_\alpha^{(1)}u_\beta^{(1)}-h_\alpha^{(1)}h_\beta^{(1)}\right)-\frac{1}{4\pi}\frac{\partial}{\partial x_\alpha^{(1)}}\int\Big[\frac{\partial u_\alpha^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial u_\beta^{(1)}}{\partial x_\alpha^{(1)}}-\frac{\partial h_\alpha^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial h_\beta^{(1)}}{\partial x_\alpha^{(1)}}\Big]$$

$$\times\frac{d\bar{x}''}{\left|\bar{x}''-\bar{x}\right|}+\nu\nabla^2 u_\alpha^{(1)}\Big\}\times\frac{\partial}{\partial v_\alpha^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\rangle$$

$$+\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$

$$\delta\left(c^{(2)}-\psi^{(2)}\right)\Big\{-\frac{\partial}{\partial x_\beta^{(1)}}\left(h_\alpha^{(1)}u_\beta^{(1)}-u_\alpha^{(1)}h_\beta^{(1)}\right)+\lambda\nabla^2 h_\alpha^{(1)}\Big\}\times\frac{\partial}{\partial g_\alpha^{(1)}}\delta\left(h^{(1)}-g^{(1)}\right)\rangle$$

$$+\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$

$$\Big\{-u_\beta^{(1)}\frac{\partial \theta^{(1)}}{\partial x_\beta^{(1)}}+\gamma\nabla^2\theta^{(1)}\Big\}\times\frac{\partial}{\partial \phi^{(1)}}\delta\left(\theta^{(1)}-\phi^{(1)}\right)\rangle+\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)$$

$$\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)\Big\{-u_\beta^{(1)}\frac{\partial c^{(1)}}{\partial x_\beta^{(1)}}+D\nabla^2 c\Big\}\frac{\partial}{\partial \psi^{(1)}}\delta\left(c^{(1)}-\psi^{(1)}\right)\rangle$$

$$+\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$

$$\{ -\frac{\partial}{\partial x_\beta^{(2)}}\left(u_\alpha^{(2)}u_\beta^{(2)} - h_\alpha^{(2)}h_\beta^{(2)}\right) - \frac{1}{4\pi}\frac{\partial}{\partial x_\alpha^{(2)}}\int \left[ \frac{\partial u_\alpha^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial u_\beta^{(2)}}{\partial x_\alpha^{(2)}} - \frac{\partial h_\alpha^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial h_\beta^{(2)}}{\partial x_\alpha^{(2)}} \right]\frac{d\overline{x}''}{\left|\overline{x}''-\overline{x}'\right|}$$

$$+\nu\nabla^2 u_\alpha^{(2)} \} \times \frac{\partial}{\partial v_\alpha^{(2)}}\delta\left(u^{(2)}-v^{(2)}\right) \rangle$$

$$+\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$

$$\delta\left(c^{(2)}-\psi^{(2)}\right)\{ -\frac{\partial}{\partial x_\beta^{(2)}}\left(h_\alpha^{(2)}u_\beta^{(2)} - u_\alpha^{(2)}h_\beta^{(2)}\right) + \lambda\nabla^2 h_\alpha^{(2)} \} \times \frac{\partial}{\partial g_\alpha^{(2)}}\delta\left(h^{(2)}-g^{(2)}\right) \rangle$$

$$+\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)$$

$$\delta\left(c^{(2)}-\psi^{(2)}\right)\{ -u_\beta^{(2)}\frac{\partial\theta^{(2)}}{\partial x_\beta^{(2)}} + \gamma\nabla^2\theta^{(2)} \} \times \frac{\partial}{\partial\phi^{(2)}}\delta\left(\theta^{(2)}-\phi^{(2)}\right) \rangle$$

$$+\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)$$

$$\delta\left(\theta^{(2)}-\phi^{(2)}\right)\{ -u_\beta^{(2)}\frac{\partial c^{(2)}}{\partial x_\beta^{(2)}} + D\nabla^2 c^{(2)} \} \times \frac{\partial}{\partial\psi^{(2)}}\delta\left(c^{(2)}-\psi^{(2)}\right) \rangle$$

$$=\langle \delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$

$$\delta\left(c^{(2)}-\psi^{(2)}\right)\times\frac{\partial u_\alpha^{(1)}u_\beta^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial v_\alpha^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right) \rangle$$

$$+\langle -\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$

$$\delta\left(c^{(2)}-\psi^{(2)}\right)\times\frac{\partial h_\alpha^{(1)}h_\beta^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial v_\alpha^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right) \rangle$$

$$+\langle \delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$

$$\delta\left(c^{(2)}-\psi^{(2)}\right)\times\frac{1}{4\pi}\frac{\partial}{\partial x_\alpha^{(1)}}\int \left[ \frac{\partial u_\alpha^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial u_\beta^{(1)}}{\partial x_\alpha^{(1)}} - \frac{\partial h_\alpha^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial h_\beta^{(1)}}{\partial x_\alpha^{(1)}} \right]\frac{d\overline{x}''}{\left|\overline{x}''-\overline{x}\right|}\frac{\partial}{\partial v_\alpha^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right) \rangle$$

$$+\langle -\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)$$

$$\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)\times\nu\nabla^2 u_\alpha^{(1)}\frac{\partial}{\partial v_\alpha^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right) \rangle$$

$$+\langle \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$

$$\delta\left(c^{(2)}-\psi^{(2)}\right)\times\frac{\partial h_\alpha^{(1)}u_\beta^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial g_\alpha^{(1)}}\delta\left(h^{(1)}-g^{(1)}\right) \rangle$$

$$+\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$

$$\delta\left(c^{(2)}-\psi^{(2)}\right)\times\frac{\partial u_\alpha^{(1)}h_\beta^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial g_\alpha^{(1)}}\delta\left(h^{(1)}-g^{(1)}\right) \rangle$$

$$+\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$

$$\delta\left(c^{(2)}-\psi^{(2)}\right)\times\lambda\nabla^2 h_\alpha^{(1)}\frac{\partial}{\partial g_\alpha^{(1)}}\delta\left(h^{(1)}-g^{(1)}\right) \rangle$$

$$+\langle \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$

$$\delta\left(c^{(2)}-\psi^{(2)}\right)\times u_\beta^{(1)}\frac{\partial\theta^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial\phi^{(1)}}\delta\left(\theta^{(1)}-\phi^{(1)}\right) \rangle$$

$$+\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$

$$\delta\left(c^{(2)}-\psi^{(2)}\right)\times\gamma\nabla^2\theta^{(1)}\frac{\partial}{\partial\phi^{(1)}}\delta\left(\theta^{(1)}-\phi^{(1)}\right) \rangle$$

$$
\begin{aligned}
&+\Big\langle\ \delta\big(u^{(1)}-v^{(1)}\big)\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\delta\big(\theta^{(2)}-\phi^{(2)}\big)\\
&\delta\big(c^{(2)}-\psi^{(2)}\big)\times u_\beta^{(1)}\frac{\partial c^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial\psi^{(1)}}\delta\big(c^{(1)}-\psi^{(1)}\big)\ \Big\rangle\\
&+\Big\langle -\delta\big(u^{(1)}-v^{(1)}\big)\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\delta\big(\theta^{(2)}-\phi^{(2)}\big)\\
&\delta\big(c^{(2)}-\psi^{(2)}\big)\times D\nabla^2 c^{(1)}\frac{\partial}{\partial\psi^{(1)}}\delta\big(c^{(1)}-\psi^{(1)}\big)\ \Big\rangle\\
&+\Big\langle \delta\big(u^{(1)}-v^{(1)}\big)\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\delta\big(\theta^{(2)}-\phi^{(2)}\big)\\
&\delta\big(c^{(2)}-\psi^{(2)}\big)\times\frac{\partial u_\alpha^{(2)}u_\beta^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial}{\partial v_\alpha^{(2)}}\delta\big(u^{(2)}-v^{(2)}\big)\ \Big\rangle\\
&+\Big\langle -\delta\big(u^{(1)}-v^{(1)}\big)\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\delta\big(\theta^{(2)}-\phi^{(2)}\big)\\
&\delta\big(c^{(2)}-\psi^{(2)}\big)\times\frac{\partial h_\alpha^{(2)}h_\beta^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial}{\partial v_\alpha^{(2)}}\delta\big(u^{(2)}-v^{(2)}\big)\ \Big\rangle\\
&+\Big\langle \delta\big(u^{(1)}-v^{(1)}\big)\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\delta\big(\theta^{(2)}-\phi^{(2)}\big)\\
&\delta\big(c^{(2)}-\psi^{(2)}\big)\times\frac{1}{4\pi}\frac{\partial}{\partial x_\alpha^{(2)}}\int\Big[\ \frac{\partial u_\alpha^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial u_\beta^{(2)}}{\partial x_\alpha^{(2)}}-\frac{\partial h_\alpha^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial h_\beta^{(2)}}{\partial x_\alpha^{(2)}}\ \Big]\frac{d\bar{x}''}{|\bar{x}''-\bar{x}'|}\frac{\partial}{\partial v_\alpha^{(2)}}\delta\big(u^{(2)}-v^{(2)}\big)\ \Big\rangle\\
&+\Big\langle -\delta\big(u^{(1)}-v^{(1)}\big)\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\delta\big(\theta^{(2)}-\phi^{(2)}\big)\\
&\delta\big(c^{(2)}-\psi^{(2)}\big)\times\nu\nabla^2 u_\alpha^{(2)}\frac{\partial}{\partial v_\alpha^{(2)}}\delta\big(u^{(2)}-v^{(2)}\big)\ \Big\rangle\\
&+\Big\langle\ \delta\big(u^{(1)}-v^{(1)}\big)\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(\theta^{(2)}-\phi^{(2)}\big)\\
&\delta\big(c^{(2)}-\psi^{(2)}\big)\times\frac{\partial h_\alpha^{(2)}u_\beta^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial}{\partial g_\alpha^{(2)}}\delta\big(h^{(2)}-g^{(2)}\big)\ \Big\rangle\\
&+\Big\langle -\delta\big(u^{(1)}-v^{(1)}\big)\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(\theta^{(2)}-\phi^{(2)}\big)\\
&\delta\big(c^{(2)}-\psi^{(2)}\big)\times\frac{\partial u_\alpha^{(2)}h_\beta^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial}{\partial g_\alpha^{(2)}}\delta\big(h^{(2)}-g^{(2)}\big)\ \Big\rangle\\
&+\Big\langle -\delta\big(u^{(1)}-v^{(1)}\big)\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(\theta^{(2)}-\phi^{(2)}\big)\\
&\delta\big(c^{(2)}-\psi^{(2)}\big)\times\lambda\nabla^2 h_\alpha^{(2)}\frac{\partial}{\partial g_\alpha^{(2)}}\delta\big(h^{(2)}-g^{(2)}\big)\ \Big\rangle\\
&+\Big\langle\ \delta\big(u^{(1)}-v^{(1)}\big)\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\\
&\delta\big(c^{(2)}-\psi^{(2)}\big)\times u_\beta^{(2)}\frac{\partial\theta^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial}{\partial\phi^{(2)}}\delta\big(\theta^{(2)}-\phi^{(2)}\big)\ \Big\rangle\\
&+\Big\langle -\delta\big(u^{(1)}-v^{(1)}\big)\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\\
&\delta\big(c^{(2)}-\psi^{(2)}\big)\times\gamma\nabla^2\theta^{(2)}\frac{\partial}{\partial\phi^{(2)}}\delta\big(\theta^{(2)}-\phi^{(2)}\big)\ \Big\rangle\\
&+\Big\langle\ \delta\big(u^{(1)}-v^{(1)}\big)\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\\
&\delta\big(\theta^{(2)}-\phi^{(2)}\big)\times u_\beta^{(2)}\frac{\partial c^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial}{\partial\psi^{(2)}}\delta\big(c^{(2)}-\psi^{(2)}\big)\ \Big\rangle\\
&+\Big\langle -\delta\big(u^{(1)}-v^{(1)}\big)\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\\
&\delta\big(\theta^{(2)}-\phi^{(2)}\big)\times D\nabla^2 c^{(2)}\frac{\partial}{\partial\psi^{(2)}}\delta\big(c^{(2)}-\psi^{(2)}\big)\ \Big\rangle
\end{aligned}
\tag{38}
$$

Various terms in the above equation can be simplified as that they may be expressed in terms of one point, two point and three point distribution functions.

1st term in the Eq. (38) is simplified as follows:

$$\begin{aligned}
&\Big\langle\ \delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\delta\big(\theta^{(2)}-\phi^{(2)}\big)\\
&\delta\big(c^{(2)}-\psi^{(2)}\big)\times\frac{\partial u_\alpha^{(1)}u_\beta^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial v_\alpha^{(1)}}\delta\big(u^{(1)}-v^{(1)}\big)\ \Big\rangle\\
&=\Big\langle u_\beta^{(1)}\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\delta\big(\theta^{(2)}-\phi^{(2)}\big)\\
&\delta\big(c^{(2)}-\psi^{(2)}\big)\times\frac{\partial u_\alpha^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial v_\alpha^{(1)}}\delta\big(u^{(1)}-v^{(1)}\big)\ \Big\rangle\\
&=\Big\langle -u_\beta^{(1)}\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\delta\big(\theta^{(2)}-\phi^{(2)}\big)\\
&\delta\big(c^{(2)}-\psi^{(2)}\big)\times\frac{\partial u_\alpha^{(1)}}{\partial v_\alpha^{(1)}}\frac{\partial}{\partial x_\beta^{(1)}}\delta\big(u^{(1)}-v^{(1)}\big)\ \Big\rangle;\qquad(\text{since }\frac{\partial u_\alpha^{(1)}}{\partial v_\alpha^{(1)}}=1)\\
&=\Big\langle -\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\delta\big(\theta^{(2)}-\phi^{(2)}\big)\\
&\delta\big(c^{(2)}-\psi^{(2)}\big)\times u_\beta^{(1)}\frac{\partial}{\partial x_\beta^{(1)}}\delta\big(u^{(1)}-v^{(1)}\big)\ \Big\rangle
\end{aligned}\tag{39}$$

Similarly, fifth, eighth and tenth terms of right hand-side of Eq. (38) can be simplified as follows:

$$\begin{aligned}
&\Big\langle\ \delta\big(u^{(1)}-v^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\delta\big(\theta^{(2)}-\phi^{(2)}\big)\\
&\delta\big(c^{(2)}-\psi^{(2)}\big)\times\frac{\partial h_\alpha^{(1)}u_\beta^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial g_\alpha^{(1)}}\delta\big(h^{(1)}-g^{(1)}\big)\ \Big\rangle\\
&=\Big\langle -\delta\big(u^{(1)}-v^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\delta\big(\theta^{(2)}-\phi^{(2)}\big)\\
&\delta\big(c^{(2)}-\psi^{(2)}\big)\times u_\beta^{(1)}\frac{\partial}{\partial x_\beta^{(1)}}\delta\big(h^{(1)}-g^{(1)}\big)\ \Big\rangle
\end{aligned}\tag{40}$$

Eighth term:

$$\begin{aligned}
&\Big\langle\ \delta\big(u^{(1)}-v^{(1)}\big)\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\delta\big(\theta^{(2)}-\phi^{(2)}\big)\\
&\delta\big(c^{(2)}-\psi^{(2)}\big)\times u_\beta^{(1)}\frac{\partial\theta^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial\phi^{(1)}}\delta\big(\theta^{(1)}-\phi^{(1)}\big)\ \Big\rangle\\
&=\Big\langle -\delta\big(u^{(1)}-v^{(1)}\big)\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\delta\big(\theta^{(2)}-\phi^{(2)}\big)\\
&\delta\big(c^{(2)}-\psi^{(2)}\big)\times u_\beta^{(1)}\frac{\partial}{\partial x_\beta^{(1)}}\delta\big(\theta^{(1)}-\phi^{(1)}\big)\ \Big\rangle
\end{aligned}\tag{41}$$

And tenth term:

$$\begin{aligned}
&\Big\langle\ \delta\big(u^{(1)}-v^{(1)}\big)\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\delta\big(\theta^{(2)}-\phi^{(2)}\big)\\
&\delta\big(c^{(2)}-\psi^{(2)}\big)\times u_\beta^{(1)}\frac{\partial c^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial\psi^{(1)}}\delta\big(c^{(1)}-\psi^{(1)}\big)\ \Big\rangle\\
&=\Big\langle -\delta\big(u^{(1)}-v^{(1)}\big)\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\\
&\delta\big(\theta^{(2)}-\phi^{(2)}\big)\delta\big(c^{(2)}-\psi^{(2)}\big)\times u_\beta^{(1)}\frac{\partial}{\partial x_\beta^{(1)}}\delta\big(c^{(1)}-\psi^{(1)}\big)\ \Big\rangle
\end{aligned}\tag{42}$$

Adding these equations from (39) to (42), we get:

$$\begin{aligned}
&\Big\langle -\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\delta\big(\theta^{(2)}-\phi^{(2)}\big)\\
&\delta\big(c^{(2)}-\psi^{(2)}\big)\times u_\beta^{(1)}\frac{\partial}{\partial x_\beta^{(1)}}\delta\big(u^{(1)}-v^{(1)}\big)\ \Big\rangle
\end{aligned}$$

$$+\langle -\delta(u^{(1)}-v^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})$$
$$\delta(c^{(2)}-\psi^{(2)})\times u_\beta^{(1)}\frac{\partial}{\partial x_\beta^{(1)}}\delta(h^{(1)}-g^{(1)})\rangle$$
$$+\langle -\delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})$$
$$\delta(c^{(2)}-\psi^{(2)})\times u_\beta^{(1)}\frac{\partial}{\partial x_\beta^{(1)}}\delta(\theta^{(1)}-\phi^{(1)})\rangle$$
$$+\langle -\delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})$$
$$\delta(c^{(2)}-\psi^{(2)})\times u_\beta^{(1)}\frac{\partial}{\partial x_\beta^{(1)}}\delta(c^{(1)}-\psi^{(1)})\rangle$$
$$=-\frac{\partial}{\partial x_\beta^{(1)}}\langle u_\beta^{(1)}\langle -\delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})$$
$$\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})\delta(c^{(2)}-\psi^{(2)})\rangle$$

$=-\frac{\partial}{\partial x_\beta^{(1)}}v_\beta^{(1)}F_2^{(1,2)}$ (Applying the properties of distribution functions):

$$=-v_\beta^{(1)}\frac{\partial F_2^{(1,2)}}{\partial x_\beta^{(1)}} \tag{43}$$

Similarly, 12th, 16th, 19th and 21st terms of right hand-side of Eq. (38) can be simplified as follows:

$$\langle \delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})$$
$$\delta(c^{(2)}-\psi^{(2)})\times\frac{\partial u_\alpha^{(2)}u_\beta^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial}{\partial v_\alpha^{(2)}}\delta(u^{(2)}-v^{(2)})\rangle$$
$$=\langle -\delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})$$
$$\delta(c^{(2)}-\psi^{(2)})\times u_\beta^{(2)}\frac{\partial}{\partial x_\beta^{(2)}}\delta(u^{(2)}-v^{(2)})\rangle \tag{44}$$

16th term:

$$\langle \delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(\theta^{(2)}-\phi^{(2)})$$
$$\delta(c^{(2)}-\psi^{(2)})\times\frac{\partial h_\alpha^{(2)}u_\beta^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial}{\partial g_\alpha^{(2)}}\delta(h^{(2)}-g^{(2)})\rangle$$
$$=\langle -\delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(\theta^{(2)}-\phi^{(2)})$$
$$\delta(c^{(2)}-\psi^{(2)})\times u_\beta^{(2)}\frac{\partial}{\partial x_\beta^{(2)}}\delta(h^{(2)}-g^{(2)})\rangle \tag{45}$$

19th term:

$$\langle \delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})$$
$$\delta(c^{(2)}-\psi^{(2)})\times u_\beta^{(2)}\frac{\partial\theta^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial}{\partial\phi^{(2)}}\delta(\theta^{(2)}-\phi^{(2)})\rangle$$
$$=\langle -\delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})$$
$$\delta(c^{(2)}-\psi^{(2)})\times u_\beta^{(2)}\frac{\partial}{\partial x_\beta^{(2)}}\delta(\theta^{(2)}-\phi^{(2)})\rangle \tag{46}$$

And 21st term:

$$\Big\langle\ \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)$$
$$\delta\left(\theta^{(2)}-\phi^{(2)}\right)\times u_{\beta}^{(2)}\frac{\partial c^{(2)}}{\partial x_{\beta}^{(2)}}\frac{\partial}{\partial\psi^{(2)}}\delta\left(c^{(2)}-\psi^{(2)}\right)\ \Big\rangle$$
$$=\Big\langle-\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)$$
$$\delta\left(\theta^{(2)}-\phi^{(2)}\right)\times u_{\beta}^{(2)}\frac{\partial}{\partial x_{\beta}^{(2)}}\delta\left(c^{(2)}-\psi^{(2)}\right)\ \Big\rangle \tag{47}$$

Adding these Eq. from (44) to (47), we get:

$$-\frac{\partial}{\partial x_{\beta}^{(2)}}\left\langle u_{\beta}^{(2)}\Big\langle\ \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\right.$$
$$\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)\ \Big\rangle$$
$$=-v_{\beta}^{(2)}\frac{\partial F_2^{(1,2)}}{\partial x_{\beta}^{(2)}} \tag{48}$$

Similarly, 2nd, 6th, 13th and 17st terms of right hand-side of Eq. (38) can be simplified as follows:

$$\Big\langle-\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$
$$\delta\left(c^{(2)}-\psi^{(2)}\right)\times\frac{\partial h_{\alpha}^{(1)}h_{\beta}^{(1)}}{\partial x_{\beta}^{(1)}}\frac{\partial}{\partial v_{\alpha}^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\ \Big\rangle$$
$$=-\,g_{\beta}^{(1)}\frac{\partial g_{\alpha}^{(1)}}{\partial v_{\alpha}^{(1)}}\frac{\partial F_2^{(1,2)}}{\partial x_{\beta}^{(1)}} \tag{49}$$

6th term:

$$\Big\langle-\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$
$$\delta\left(c^{(2)}-\psi^{(2)}\right)\times\frac{\partial u_{\alpha}^{(1)}h_{\beta}^{(1)}}{\partial x_{\beta}^{(1)}}\frac{\partial}{\partial g_{\alpha}^{(1)}}\delta\left(h^{(1)}-g^{(1)}\right)\Big\rangle$$
$$=-\,g_{\beta}^{(1)}\frac{\partial v_{\alpha}^{(1)}}{\partial g_{\alpha}^{(1)}}\frac{\partial F_2^{(1,2)}}{\partial x_{\beta}^{(1)}} \tag{50}$$

13th term:

$$\Big\langle-\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$
$$\delta\left(c^{(2)}-\psi^{(2)}\right)\times\frac{\partial h_{\alpha}^{(2)}h_{\beta}^{(2)}}{\partial x_{\beta}^{(2)}}\frac{\partial}{\partial v_{\alpha}^{(2)}}\delta\left(u^{(2)}-v^{(2)}\right)\ \Big\rangle$$
$$=-\,g_{\beta}^{(2)}\frac{\partial g_{\alpha}^{(2)}}{\partial v_{\alpha}^{(2)}}\frac{\partial F_2^{(1,2)}}{\partial x_{\beta}^{(2)}} \tag{51}$$

And 17th term:

$$\Big\langle-\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$
$$\delta\left(c^{(2)}-\psi^{(2)}\right)\times\frac{\partial u_{\alpha}^{(2)}h_{\beta}^{(2)}}{\partial x_{\beta}^{(2)}}\frac{\partial}{\partial g_{\alpha}^{(2)}}\delta\left(h^{(2)}-g^{(2)}\right)\Big\rangle$$
$$=-\,g_{\beta}^{(2)}\frac{\partial v_{\alpha}^{(2)}}{\partial g_{\alpha}^{(2)}}\frac{\partial F_2^{(1,2)}}{\partial x_{\beta}^{(2)}} \tag{52}$$

Fourth term can be reduced as:

$$\langle -\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$
$$\delta\left(c^{(2)}-\psi^{(2)}\right)\times\nu\nabla^2 u_\alpha^{(1)}\frac{\partial}{\partial v_\alpha^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\rangle$$
$$=-\nu\frac{\partial}{\partial v_\alpha^{(1)}}\langle\nabla^2 u_\alpha^{(1)}[\ \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)$$
$$\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)\ ]\ \rangle$$
$$=-\nu\frac{\partial}{\partial v_\alpha^{(1)}}\frac{\partial^2}{\partial x_\beta^{(1)}\partial x_\beta^{(1)}}\langle u_\alpha^{(1)}[\ \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)$$
$$\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)\ ]\ \rangle$$
$$=-\nu\frac{\partial}{\partial v_\alpha^{(1)}}\lim_{\bar{x}^{(3)}\to\bar{x}^{(1)}}\frac{\partial^2}{\partial x_\beta^{(3)}\partial x_\beta^{(3)}}\langle u_\alpha^{(3)}[\ \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)$$
$$\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)\ ]\ \rangle$$
$$=-\nu\frac{\partial}{\partial v_\alpha^{(1)}}\lim_{\bar{x}^{(3)}\to\bar{x}^{(1)}}\frac{\partial^2}{\partial x_\beta^{(3)}\partial x_\beta^{(3)}}\langle\int u_\alpha^{(3)}\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)$$
$$\delta\left(c^{(3)}-\psi^{(3)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(u^{(1)}-v^{(1)}\right)$$
$$\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)dv^{(3)}dg^{(3)}d\phi^{(3)}d\psi^{(3)}\ \rangle$$
$$=-\nu\frac{\partial}{\partial v_\alpha^{(1)}}\lim_{\bar{x}^{(3)}\to\bar{x}^{(1)}}\frac{\partial^2}{\partial x_\beta^{(3)}\partial x_\beta^{(3)}}\int v_\alpha^{(3)}F_3^{(1,2,3)}dv^{(3)}dg^{(3)}d\phi^{(3)}d\psi^{(3)} \tag{53}$$

Similarly, 7th, 9th, 11th, 15th, 18th, 20th and 22nd terms of right hand-side of Eq. (38) can be simplified as follows:

$$\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$
$$\delta\left(c^{(2)}-\psi^{(2)}\right)\times\lambda\nabla^2 h_\alpha^{(1)}\frac{\partial}{\partial g_\alpha^{(1)}}\delta\left(h^{(1)}-g^{(1)}\right)\ \rangle$$
$$=-\lambda\frac{\partial}{\partial g_\alpha^{(1)}}\lim_{\bar{x}^{(3)}\to\bar{x}^{(1)}}\frac{\partial^2}{\partial x_\beta^{(3)}\partial x_\beta^{(3)}}\int g_\alpha^{(3)}F_3^{(1,2,3)}dv^{(3)}dg^{(3)}d\phi^{(3)}d\psi^{(3)} \tag{54}$$

9th term:

$$\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$
$$\delta\left(c^{(2)}-\psi^{(2)}\right)\times\gamma\nabla^2\theta^{(1)}\frac{\partial}{\partial\phi^{(1)}}\delta\left(\theta^{(1)}-\phi^{(1)}\right)\ \rangle \tag{55}$$

11th term:

$$\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$
$$\delta\left(c^{(2)}-\psi^{(2)}\right)\times D\nabla^2 c^{(1)}\frac{\partial}{\partial\psi^{(1)}}\delta\left(c^{(1)}-\psi^{(1)}\right)\ \rangle$$
$$=-D\frac{\partial}{\partial\psi^{(1)}}\lim_{\bar{x}^{(3)}\to\bar{x}^{(1)}}\frac{\partial^2}{\partial x_\beta^{(3)}\partial x_\beta^{(3)}}\int\psi^{(3)}F_3^{(1,2,3)}dv^{(3)}dg^{(3)}d\phi^{(3)}d\psi^{(3)} \tag{56}$$

15th term:

$$\Big\langle -\delta\big(u^{(1)}-v^{(1)}\big)\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\delta\big(\theta^{(2)}-\phi^{(2)}\big)$$
$$\delta\big(c^{(2)}-\psi^{(2)}\big)\times \nu\nabla^2 u_\alpha^{(2)}\frac{\partial}{\partial v_\alpha^{(2)}}\delta\big(u^{(2)}-v^{(2)}\big)\Big\rangle$$
$$=-\nu\frac{\partial}{\partial v_\alpha^{(2)}}\lim_{\bar{x}^{(3)}\to\bar{x}^{(2)}}\frac{\partial^2}{\partial x_\beta^{(3)}\partial x_\beta^{(3)}}\int v_\alpha^{(3)}F_3^{(1,2,3)}dv^{(3)}dg^{(3)}d\phi^{(3)}d\psi^{(3)} \tag{57}$$

18th term:

$$\Big\langle -\delta\big(u^{(1)}-v^{(1)}\big)\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(\theta^{(2)}-\phi^{(2)}\big)$$
$$\delta\big(c^{(2)}-\psi^{(2)}\big)\times \lambda\nabla^2 h_\alpha^{(2)}\frac{\partial}{\partial g_\alpha^{(2)}}\delta\big(h^{(2)}-g^{(2)}\big)\Big\rangle$$
$$=-\lambda\frac{\partial}{\partial g_\alpha^{(2)}}\lim_{\bar{x}^{(3)}\to\bar{x}^{(2)}}\frac{\partial^2}{\partial x_\beta^{(3)}\partial x_\beta^{(3)}}\int g_\alpha^{(3)}F_3^{(1,2,3)}dv^{(3)}dg^{(3)}d\phi^{(3)}d\psi^{(3)} \tag{58}$$

20th term:

$$\Big\langle -\delta\big(u^{(1)}-v^{(1)}\big)\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(h^{(2)}-g^{(2)}\big)$$
$$\delta\big(c^{(2)}-\psi^{(2)}\big)\times \gamma\nabla^2 \theta^{(2)}\frac{\partial}{\partial \phi^{(2)}}\delta\big(\theta^{(2)}-\phi^{(2)}\big)\Big\rangle$$
$$=-\gamma\frac{\partial}{\partial \phi^{(2)}}\lim_{\bar{x}^{(3)}\to\bar{x}^{(2)}}\frac{\partial^2}{\partial x_\beta^{(3)}\partial x_\beta^{(3)}}\int \phi^{(3)}F_3^{(1,2,3)}dv^{(3)}dg^{(3)}d\phi^{(3)}d\psi^{(3)} \tag{59}$$

22nd term:

$$\Big\langle -\delta\big(u^{(1)}-v^{(1)}\big)\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(h^{(2)}-g^{(2)}\big)$$
$$\delta\big(\theta^{(2)}-\phi^{(2)}\big)\times D\nabla^2 c^{(2)}\frac{\partial}{\partial \psi^{(2)}}\delta\big(c^{(2)}-\psi^{(2)}\big)\Big\rangle$$
$$=-D\frac{\partial}{\partial \psi^{(2)}}\lim_{\bar{x}^{(3)}\to\bar{x}^{(2)}}\frac{\partial^2}{\partial x_\beta^{(3)}\partial x_\beta^{(3)}}\int \psi^{(3)}F_3^{(1,2,3)}dv^{(3)}dg^{(3)}d\phi^{(3)}d\psi^{(3)} \tag{60}$$

We reduce the third term of right-hand side of Eq. (38):

$$\Big\langle\ \delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\delta\big(\theta^{(2)}-\phi^{(2)}\big)$$
$$\delta\big(c^{(2)}-\psi^{(2)}\big)\times\frac{1}{4\pi}\frac{\partial}{\partial x_\alpha^{(1)}}\int\Big[\ \frac{\partial u_\alpha^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial u_\beta^{(1)}}{\partial x_\alpha^{(1)}}-\frac{\partial h_\alpha^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial h_\beta^{(1)}}{\partial x_\alpha^{(1)}}\ \Big]\frac{d\bar{x}''}{|\bar{x}''-\bar{x}|}\frac{\partial}{\partial v_\alpha^{(1)}}\delta\big(u^{(1)}-v^{(1)}\big)\Big\rangle$$
$$=\frac{\partial}{\partial v_\alpha^{(1)}}\Big[\ \frac{1}{4\pi}\int\ \frac{\partial}{\partial x_\alpha^{(1)}}\Big(\ \frac{1}{\left|\bar{x}^{(3)}-\bar{x}^{(1)}\right|}\ \Big)\Big(\ \frac{\partial v_\alpha^{(3)}}{\partial x_\beta^{(3)}}\frac{\partial v_\beta^{(3)}}{\partial x_\alpha^{(3)}}-\frac{\partial g_\alpha^{(3)}}{\partial x_\beta^{(3)}}\frac{\partial g_\beta^{(3)}}{\partial x_\alpha^{(3)}}\ \Big)F_3^{(1,2,3)}$$
$$\times dx^{(3)}dv^{(3)}dg^{(3)}d\phi^{(3)}d\psi^{(3)}\ \Big] \tag{61}$$

Similarly, 14th term:

$$\Big\langle \delta\big(u^{(1)}-v^{(1)}\big)\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\delta\big(\theta^{(2)}-\phi^{(2)}\big)$$

$$\delta\big(c^{(2)}-\psi^{(2)}\big)\times\frac{1}{4\pi}\frac{\partial}{\partial x_\alpha^{(2)}}\int\Big[\frac{\partial u_\alpha^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial u_\beta^{(2)}}{\partial x_\alpha^{(2)}}-\frac{\partial h_\alpha^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial h_\beta^{(2)}}{\partial x_\alpha^{(2)}}\Big]\frac{d\overline{x}''}{\left|\overline{x}''-\overline{x}'\right|}\frac{\partial}{\partial v_\alpha^{(2)}}\delta\big(u^{(2)}-v^{(2)}\big)\Big\rangle$$

$$=\frac{\partial}{\partial v_\alpha^{(2)}}\Big[\frac{1}{4\pi}\int\frac{\partial}{\partial x_\alpha^{(2)}}\Big(\frac{1}{\left|\overline{x}^{(3)}-\overline{x}^{(2)}\right|}\Big)\Big(\frac{\partial v_\alpha^{(3)}}{\partial x_\beta^{(3)}}\frac{\partial v_\beta^{(3)}}{\partial x_\alpha^{(3)}}-\frac{\partial g_\alpha^{(3)}}{\partial x_\beta^{(3)}}\frac{\partial g_\beta^{(3)}}{\partial x_\alpha^{(3)}}\Big)F_3^{(1,2,3)}$$

$$\times dx^{(3)}dv^{(3)}dg^{(3)}d\phi^{(3)}d\psi^{(3)}\Big] \tag{62}$$

Substituting the results (39)-(62) in Eq. (38) we get the transport equation for two point distribution function $F_2^{(1,2)}(v,g,\phi,\psi)$ in MHD turbulent flow as:

$$\frac{\partial F_2^{(1,2)}}{\partial t}+\Big(v_\beta^{(1)}\frac{\partial}{\partial x_\beta^{(1)}}+v_\beta^{(2)}\frac{\partial}{\partial x_\beta^{(2)}}\Big)F_2^{(1,2)}+g_\beta^{(1)}\Big(\frac{\partial g_\alpha^{(1)}}{\partial v_\alpha^{(1)}}+\frac{\partial v_\alpha^{(1)}}{\partial g_\alpha^{(1)}}\Big)\frac{\partial}{\partial x_\beta^{(1)}}F_2^{(1,2)}$$

$$+g_\beta^{(2)}\Big(\frac{\partial g_\alpha^{(2)}}{\partial v_\alpha^{(2)}}+\frac{\partial v_\alpha^{(2)}}{\partial g_\alpha^{(2)}}\Big)\frac{\partial}{\partial x_\beta^{(2)}}F_2^{(1,2)}-\frac{\partial}{\partial v_\alpha^{(1)}}\Big[\frac{1}{4\pi}\int\frac{\partial}{\partial x_\alpha^{(1)}}\Big(\frac{1}{\left|\overline{x}^{(3)}-\overline{x}^{(1)}\right|}\Big)$$

$$\times\Big(\frac{\partial v_\alpha^{(3)}}{\partial x_\beta^{(3)}}\frac{\partial v_\beta^{(3)}}{\partial x_\alpha^{(3)}}-\frac{\partial g_\alpha^{(3)}}{\partial x_\beta^{(3)}}\frac{\partial g_\beta^{(3)}}{\partial x_\alpha^{(3)}}\Big)F_3^{(1,2,3)}dx^{(3)}dv^{(3)}dg^{(3)}d\phi^{(3)}d\psi^{3)}\Big]$$

$$-\frac{\partial}{\partial v_\alpha^{(2)}}\Big[\frac{1}{4\pi}\int\frac{\partial}{\partial x_\alpha^{(2)}}\Big(\frac{1}{\left|\overline{x}^{(3)}-\overline{x}^{(2)}\right|}\Big)\Big(\frac{\partial v_\alpha^{(3)}}{\partial x_\beta^{(3)}}\frac{\partial v_\beta^{(3)}}{\partial x_\alpha^{(3)}}-\frac{\partial g_\alpha^{(3)}}{\partial x_\beta^{(3)}}\frac{\partial g_\beta^{(3)}}{\partial x_\alpha^{(3)}}\Big)\times F_3^{(1,2,3)}dx^{(3)}dv^{(3)}dg^{(3)}d\phi^{(3)}d\psi^{3)}\Big]$$

$$+\nu\Big(\frac{\partial}{\partial v_\alpha^{(1)}}\lim_{\overline{x}^{(3)}\to\overline{x}^{(1)}}+\frac{\partial}{\partial v_\alpha^{(2)}}\lim_{\overline{x}^{(3)}\to\overline{x}^{(2)}}\Big)\frac{\partial^2}{\partial x_\beta^{(3)}\partial x_\beta^{(3)}}\int v_\alpha^{(3)}F_3^{(1,2,3)}dv^{(3)}dg^{(3)}d\phi^{(3)}d\psi^{(3)}$$

$$+\lambda\Big(\frac{\partial}{\partial g_\alpha^{(1)}}\lim_{\overline{x}^{(3)}\to\overline{x}^{(1)}}+\frac{\partial}{\partial g_\alpha^{(2)}}\lim_{\overline{x}^{(3)}\to\overline{x}^{(2)}}\Big)\frac{\partial^2}{\partial x_\beta^{(3)}\partial x_\beta^{(3)}}\int g_\alpha^{(3)}F_3^{(1,2,3)}dv^{(3)}dg^{(3)}d\phi^{(3)}d\psi^{(3)}$$

$$+\gamma\Big(\frac{\partial}{\partial \phi^{(1)}}\lim_{\overline{x}^{(3)}\to\overline{x}^{(1)}}+\frac{\partial}{\partial \phi^{(2)}}\lim_{\overline{x}^{(3)}\to\overline{x}^{(2)}}\Big)\frac{\partial^2}{\partial x_\beta^{(3)}\partial x_\beta^{(3)}}\int \phi^{(3)}F_3^{(1,2,3)}dv^{(3)}dg^{(3)}d\phi^{(3)}d\psi^{(3)}$$

$$+D\Big(\frac{\partial}{\partial \psi^{(1)}}\lim_{\overline{x}^{(3)}\to\overline{x}^{(1)}}+\frac{\partial}{\partial \psi^{(2)}}\lim_{\overline{x}^{(3)}\to\overline{x}^{(2)}}\Big)\frac{\partial^2}{\partial x_\beta^{(3)}\partial x_\beta^{(3)}}\int \psi^{(3)}F_3^{(1,2,3)}dv^{(3)}dg^{(3)}d\phi^{(3)}d\psi^{(3)}=0 \tag{63}$$

**Equations for three-point distribution function $F_3^{(1,2,3)}$:** Differentiating Eq. (14) partially with respect to time, making some suitable operations on the right-hand side of the equation so obtained and lastly replacing the time derivative of $u,h,\theta$ and c from the Eq. (8) to (11):

$$\frac{\partial F_3^{(1,2,3)}}{\partial t}=\frac{\partial}{\partial t}\Big\langle\delta\big(u^{(1)}-v^{(1)}\big)\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(h^{(2)}-g^{(2)}\big)$$

$$\delta\big(\theta^{(2)}-\phi^{(2)}\big)\delta\big(c^{(2)}-\psi^{(2)}\big)\delta\big(u^{(3)}-v^{(3)}\big)\delta\big(h^{(3)}-g^{(3)}\big)\delta\big(\theta^{(3)}-\phi^{(3)}\big)\delta\big(c^{(3)}-\psi^{(3)}\big)\Big\rangle$$

$$=\Big\langle\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\delta\big(\theta^{(2)}-\phi^{(2)}\big)$$

$$\delta\big(c^{(2)}-\psi^{(2)}\big)\delta\big(u^{(3)}-v^{(3)}\big)\delta\big(h^{(3)}-g^{(3)}\big)\delta\big(\theta^{(3)}-\phi^{(3)}\big)\delta\big(c^{(3)}-\psi^{(3)}\big)\frac{\partial}{\partial t}\delta\big(u^{(1)}-v^{(1)}\big)\Big\rangle$$

$$+\Big\langle\delta\big(u^{(1)}-v^{(1)}\big)\delta\big(\theta^{(1)}-\phi^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\delta\big(\theta^{(2)}-\phi^{(2)}\big)$$

$$\delta\big(c^{(2)}-\psi^{(2)}\big)\delta\big(u^{(3)}-v^{(3)}\big)\delta\big(h^{(3)}-g^{(3)}\big)\delta\big(\theta^{(3)}-\phi^{(3)}\big)\delta\big(c^{(3)}-\psi^{(3)}\big)\frac{\partial}{\partial t}\delta\big(h^{(1)}-g^{(1)}\big)\Big\rangle$$

$$+\Big\langle\delta\big(u^{(1)}-v^{(1)}\big)\delta\big(h^{(1)}-g^{(1)}\big)\delta\big(c^{(1)}-\psi^{(1)}\big)\delta\big(u^{(2)}-v^{(2)}\big)\delta\big(h^{(2)}-g^{(2)}\big)\delta\big(\theta^{(2)}-\phi^{(2)}\big)$$

$$\delta\big(c^{(2)}-\psi^{(2)}\big)\delta\big(u^{(3)}-v^{(3)}\big)\delta\big(h^{(3)}-g^{(3)}\big)\delta\big(\theta^{(3)}-\phi^{(3)}\big)\delta\big(c^{(3)}-\psi^{(3)}\big)\frac{\partial}{\partial t}\delta\big(\theta^{(1)}-\phi^{(1)}\big)\Big\rangle$$

$$+\langle\ \delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})$$
$$\delta(c^{(2)}-\psi^{(2)})\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\frac{\partial}{\partial t}\delta(c^{(1)}-\psi^{(1)})\ \rangle$$

$$+\langle\ \delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})$$
$$\delta(c^{(2)}-\psi^{(2)})\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\frac{\partial}{\partial t}\delta(u^{(2)}-v^{(2)})\ \rangle$$

$$+\langle\ \delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(\theta^{(2)}-\phi^{(2)})$$
$$\delta(c^{(2)}-\psi^{(2)})\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\frac{\partial}{\partial t}\delta(h^{(2)}-g^{(2)})\ \rangle$$

$$+\langle\ \delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})$$
$$\delta(c^{(2)}-\psi^{(2)})\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\frac{\partial}{\partial t}\delta(\theta^{(2)}-\phi^{(2)})\ \rangle$$

$$+\langle\ \delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})$$
$$\delta(\theta^{(2)}-\phi^{(2)})\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\frac{\partial}{\partial t}\delta(c^{(2)}-\psi^{(2)})\rangle$$

$$+\langle\ \delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})$$
$$\delta(\theta^{(2)}-\phi^{(2)})\delta(c^{(2)}-\psi^{(2)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\frac{\partial}{\partial t}\delta(u^{(3)}-v^{(3)})\ \rangle$$

$$+\langle\ \delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})$$
$$\delta(\theta^{(2)}-\phi^{(2)})\delta(c^{(2)}-\psi^{(2)})\delta(u^{(3)}-v^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\frac{\partial}{\partial t}\delta(h^{(3)}-g^{(3)})\ \rangle$$

$$+\langle\ \delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})$$
$$\delta(\theta^{(2)}-\phi^{(2)})\delta(c^{(2)}-\psi^{(2)})\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(c^{(3)}-\psi^{(3)})\frac{\partial}{\partial t}\delta(\theta^{(3)}-\phi^{(3)})\ \rangle$$

$$+\langle\ \delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})$$
$$\delta(\theta^{(2)}-\phi^{(2)})\delta(c^{(2)}-\psi^{(2)})\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\frac{\partial}{\partial t}\delta(c^{(3)}-\psi^{(3)})\rangle$$

$$=\langle-\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})$$
$$\delta(c^{(2)}-\psi^{(2)})\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\frac{\partial u^{(1)}}{\partial t}\frac{\partial}{\partial v^{(1)}}\delta(u^{(1)}-v^{(1)})\ \rangle$$

$$+\langle-\delta(u^{(1)}-v^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})\delta(c^{(2)}-\psi^{(2)})$$
$$\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\frac{\partial h^{(1)}}{\partial t}\frac{\partial}{\partial g^{(1)}}\delta(h^{(1)}-g^{(1)})\ \rangle$$

$$+\langle-\delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})\delta(c^{(2)}-\psi^{(2)})$$
$$\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\frac{\partial \theta^{(1)}}{\partial t}\frac{\partial}{\partial \phi^{(1)}}\delta(\theta^{(1)}-\phi^{(1)})\ \rangle$$

$$+\langle-\delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})\delta(c^{(2)}-\psi^{(2)})$$
$$\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\frac{\partial c^{(1)}}{\partial t}\frac{\partial}{\partial \psi^{(1)}}\delta(c^{(1)}-\psi^{(1)})\ \rangle$$

$$+\langle-\delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})\delta(c^{(2)}-\psi^{(2)})$$
$$\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\frac{\partial u^{(2)}}{\partial t}\frac{\partial}{\partial v^{(2)}}\delta(u^{(2)}-v^{(2)})\ \rangle$$

$$+\langle-\delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(\theta^{(2)}-\phi^{(2)})\delta(c^{(2)}-\psi^{(2)})$$
$$\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\frac{\partial h^{(2)}}{\partial t}\frac{\partial}{\partial g^{(2)}}\delta(h^{(2)}-g^{(2)})\ \rangle$$

$$+\langle-\delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})\delta(c^{(2)}-\psi^{(2)})$$
$$\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\frac{\partial \theta^{(2)}}{\partial t}\frac{\partial}{\partial \phi^{(2)}}\delta(\theta^{(2)}-\phi^{(2)})\ \rangle$$

$$+\langle -\delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})$$
$$\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\frac{\partial c^{(2)}}{\partial t}\frac{\partial}{\partial \psi^{(2)}}\delta(c^{(2)}-\psi^{(2)})\rangle$$
$$+\langle -\delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})$$
$$\delta(c^{(2)}-\psi^{(2)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\frac{\partial u^{(3)}}{\partial t}\frac{\partial}{\partial v^{(3)}}\delta(u^{(3)}-v^{(3)})\rangle$$
$$+\langle -\delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})$$
$$\delta(c^{(2)}-\psi^{(2)})\delta(u^{(3)}-v^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\frac{\partial h^{(3)}}{\partial t}\frac{\partial}{\partial g^{(3)}}\delta(h^{(3)}-g^{(3)})\rangle$$
$$+\langle -\delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})$$
$$\delta(c^{(2)}-\psi^{(2)})\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(c^{(3)}-\psi^{(3)})\frac{\partial \theta^{(3)}}{\partial t}\frac{\partial}{\partial \phi^{(3)}}\delta(\theta^{(3)}-\phi^{(3)})\rangle$$
$$+\langle -\delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})$$
$$\delta(c^{(2)}-\psi^{(2)})\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\frac{\partial c^{(3)}}{\partial t}\frac{\partial}{\partial \psi^{(3)}}\delta(c^{(3)}-\psi^{(3)})\rangle$$

Using, Eq. (8) to (11), we get:

$$=\langle -\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})$$
$$\delta(c^{(2)}-\psi^{(2)})\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})$$
$$\{\ -\frac{\partial}{\partial x_\beta^{(1)}}(u_\alpha^{(1)}u_\beta^{(1)}-h_\alpha^{(1)}h_\beta^{(1)})-\frac{1}{4\pi}\frac{\partial}{\partial x_\alpha^{(1)}}\int\ [\ \frac{\partial u_\alpha^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial u_\beta^{(1)}}{\partial x_\alpha^{(1)}}-\frac{\partial h_\alpha^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial h_\beta^{(1)}}{\partial x_\alpha^{(1)}}\ ]\frac{d\overline{x}'''}{|\overline{x}'''-\overline{x}|}$$
$$+\nu\nabla^2 u_\alpha^{(1)}\ \}\times\frac{\partial}{\partial v_\alpha^{(1)}}\delta(u^{(1)}-v^{(1)})\rangle$$
$$+\langle -\delta(u^{(1)}-v^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})$$
$$\delta(c^{(2)}-\psi^{(2)})\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})$$
$$\{\ -\frac{\partial}{\partial x_\beta^{(1)}}(h_\alpha^{(1)}u_\beta^{(1)}-u_\alpha^{(1)}h_\beta^{(1)})+\lambda\nabla^2 h_\alpha^{(1)}\ \}\times\frac{\partial}{\partial g_\alpha^{(1)}}\delta(h^{(1)}-g^{(1)})\rangle$$
$$+\langle -\delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})$$
$$\delta(c^{(2)}-\psi^{(2)})\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})$$
$$\times\{-u_\beta^{(1)}\frac{\partial\theta^{(1)}}{\partial x_\beta^{(1)}}+\gamma\nabla^2\theta^{(1)}\ \}\times\frac{\partial}{\partial\phi^{(1)}}\delta(\theta^{(1)}-\phi^{(1)})\rangle$$
$$+\langle -\delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})$$
$$\delta(c^{(2)}-\psi^{(2)})\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})$$
$$\{-u_\beta^{(1)}\frac{\partial c^{(1)}}{\partial x_\beta^{(1)}}+D\nabla^2 c^{(1)}\}\times\frac{\partial}{\partial\psi^{(1)}}\delta(c^{(1)}-\psi^{(1)})\rangle$$
$$+\langle -\delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})$$
$$\delta(c^{(2)}-\psi^{(2)})\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})$$
$$\{\ -\frac{\partial}{\partial x_\beta^{(2)}}(u_\alpha^{(2)}u_\beta^{(2)}-h_\alpha^{(2)}h_\beta^{(2)})-\frac{1}{4\pi}\frac{\partial}{\partial x_\alpha^{(2)}}\int\ [\ \frac{\partial u_\alpha^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial u_\beta^{(2)}}{\partial x_\alpha^{(2)}}-\frac{\partial h_\alpha^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial h_\beta^{(2)}}{\partial x_\alpha^{(2)}}\ ]\frac{d\overline{x}'''}{|\overline{x}'''-\overline{x}'|}$$

$$+\nu\nabla^2 u_\alpha^{(2)} \;\}\times\frac{\partial}{\partial v_\alpha^{(2)}}\delta\left(u^{(2)}-v^{(2)}\right)\rangle$$

$$+\langle-\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$

$$\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)$$

$$\{\; -\frac{\partial}{\partial x_\beta^{(2)}}\left(h_\alpha^{(2)}u_\beta^{(2)}-u_\alpha^{(2)}h_\beta^{(2)}\right)+\lambda\nabla^2 h_\alpha^{(2)} \;\}\frac{\partial}{\partial g_\alpha^{(2)}}\delta\left(h^{(2)}-g^{(2)}\right)\rangle$$

$$+\langle-\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)$$

$$\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)$$

$$\times\{-u_\beta^{(2)}\frac{\partial\theta^{(2)}}{\partial x_\beta^{(2)}}+\gamma\nabla^2\theta^{(2)} \;\}\times\frac{\partial}{\partial\phi^{(2)}}\delta\left(\theta^{(2)}-\phi^{(2)}\right)\rangle$$

$$+\langle-\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)$$

$$\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)$$

$$\{-u_\beta^{(2)}\frac{\partial c^{(2)}}{\partial x_\beta^{(2)}}+D\nabla^2 c^{(2)} \;\}\frac{\partial}{\partial\psi^{(2)}}\delta\left(c^{(2)}-\psi^{(2)}\right)\rangle$$

$$+\langle-\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)$$

$$\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)$$

$$\{\; -\frac{\partial}{\partial x_\beta^{(3)}}\left(u_\alpha^{(3)}u_\beta^{(3)}-h_\alpha^{(3)}h_\beta^{(3)}\right)-\frac{1}{4\pi}\frac{\partial}{\partial x_\alpha^{(3)}}\int\;[\;\frac{\partial u_\alpha^{(3)}}{\partial x_\beta^{(3)}}\frac{\partial u_\beta^{(3)}}{\partial x_\alpha^{(3)}}-\frac{\partial h_\alpha^{(3)}}{\partial x_\beta^{(3)}}\frac{\partial h_\beta^{(3)}}{\partial x_\alpha^{(3)}}\;]\frac{d\bar{x}'''}{\left|\bar{x}'''-\bar{x}''\right|}$$

$$+\nu\nabla^2 u_\alpha^{(3)} \;\}\times\frac{\partial}{\partial v_\alpha^{(3)}}\delta\left(u^{(3)}-v^{(3)}\right)\rangle$$

$$+\langle-\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)$$

$$\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)$$

$$\{\; -\frac{\partial}{\partial x_\beta^{(3)}}\left(h_\alpha^{(3)}u_\beta^{(3)}-u_\alpha^{(3)}h_\beta^{(3)}\right)+\lambda\nabla^2 h_\alpha^{(3)} \;\}\frac{\partial}{\partial g_\alpha^{(3)}}\delta\left(h^{(3)}-g^{(3)}\right)\rangle$$

$$+\langle-\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)$$

$$\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)$$

$$\times\{-u_\beta^{(3)}\frac{\partial\theta^{(3)}}{\partial x_\beta^{(3)}}+\gamma\nabla^2\theta^{(3)} \;\}\times\frac{\partial}{\partial\phi^{(3)}}\delta\left(\theta^{(3)}-\phi^{(3)}\right)\rangle$$

$$+\langle-\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)$$

$$\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)$$

$$\{-u_\beta^{(3)}\frac{\partial c^{(3)}}{\partial x_\beta^{(3)}}+D\nabla^2 c^{(3)} \;\}\frac{\partial}{\partial\psi^{(3)}}\delta\left(c^{(3)}-\psi^{(3)}\right)\rangle$$

$$=\langle\;\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$

$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times\frac{\partial u_\alpha^{(1)}u_\beta^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial v_\alpha^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\rangle$$

$$+\langle-\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$

$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times\frac{\partial h_\alpha^{(1)}h_\beta^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial v_\alpha^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\rangle$$

$$+\langle\ \delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})\delta(c^{(2)}-\psi^{(2)})$$

$$\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\times\frac{1}{4\pi}\frac{\partial}{\partial x_\alpha^{(1)}}\int\left[\ \frac{\partial u_\alpha^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial u_\beta^{(1)}}{\partial x_\alpha^{(1)}}-\frac{\partial h_\alpha^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial h_\beta^{(1)}}{\partial x_\alpha^{(1)}}\ \right]$$

$$\times\frac{d\bar{x}'''}{|\bar{x}'''-\bar{x}|}\frac{\partial}{\partial v_\alpha^{(1)}}\delta(u^{(1)}-v^{(1)})\ \rangle+\langle-\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})$$

$$\delta(\theta^{(2)}-\phi^{(2)})\delta(c^{(2)}-\psi^{(2)})\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\times\nu\nabla^2u_\alpha^{(1)}\frac{\partial}{\partial v_\alpha^{(1)}}\delta(u^{(1)}-v^{(1)})\ \rangle$$

$$+\langle\ \delta(u^{(1)}-v^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})\delta(c^{(2)}-\psi^{(2)})$$

$$\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\times\frac{\partial h_\alpha^{(1)}u_\beta^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial g_\alpha^{(1)}}\delta(h^{(1)}-g^{(1)})\ \rangle$$

$$+\langle-\delta(u^{(1)}-v^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})\delta(c^{(2)}-\psi^{(2)})$$

$$\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\times\frac{\partial u_\alpha^{(1)}h_\beta^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial g_\alpha^{(1)}}\delta(h^{(1)}-g^{(1)})\ \rangle$$

$$+\langle-\delta(u^{(1)}-v^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})\delta(c^{(2)}-\psi^{(2)})$$

$$\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\times\lambda\nabla^2h_\alpha^{(1)}\frac{\partial}{\partial g_\alpha^{(1)}}\delta(h^{(1)}-g^{(1)})\ \rangle$$

$$+\langle\ \delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})\delta(c^{(2)}-\psi^{(2)})$$

$$\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\times u_\beta^{(1)}\frac{\partial\theta^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial\phi^{(1)}}\delta(\theta^{(1)}-\phi^{(1)})\ \rangle$$

$$+\langle-\delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})\delta(c^{(2)}-\psi^{(2)})$$

$$\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\times\gamma\nabla^2\theta^{(1)}\frac{\partial}{\partial\phi^{(1)}}\delta(\theta^{(1)}-\phi^{(1)})\ \rangle$$

$$+\langle\ \delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})\delta(c^{(2)}-\psi^{(2)})$$

$$\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\times u_\beta^{(1)}\frac{\partial c^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial\psi^{(1)}}\delta(c^{(1)}-\psi^{(1)})\ \rangle$$

$$+\langle-\delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(u^{(2)}-v^{(2)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})\delta(c^{(2)}-\psi^{(2)})$$

$$\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\times D\nabla^2c^{(1)}\frac{\partial}{\partial\psi^{(1)}}\delta(c^{(1)}-\psi^{(1)})\ \rangle$$

$$+\langle\delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})\delta(c^{(2)}-\psi^{(2)})$$

$$\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\times\frac{\partial u_\alpha^{(2)}u_\beta^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial}{\partial v_\alpha^{(2)}}\delta(u^{(2)}-v^{(2)})\ \rangle$$

$$+\langle-\delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})\delta(c^{(2)}-\psi^{(2)})$$

$$\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\times\frac{\partial h_\alpha^{(2)}h_\beta^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial}{\partial v_\alpha^{(2)}}\delta(u^{(2)}-v^{(2)})\ \rangle$$

$$+\langle\delta(u^{(1)}-v^{(1)})\delta(h^{(1)}-g^{(1)})\delta(\theta^{(1)}-\phi^{(1)})\delta(c^{(1)}-\psi^{(1)})\delta(h^{(2)}-g^{(2)})\delta(\theta^{(2)}-\phi^{(2)})\delta(c^{(2)}-\psi^{(2)})$$

$$\delta(u^{(3)}-v^{(3)})\delta(h^{(3)}-g^{(3)})\delta(\theta^{(3)}-\phi^{(3)})\delta(c^{(3)}-\psi^{(3)})\times\frac{1}{4\pi}\frac{\partial}{\partial x_\alpha^{(2)}}\int\left[\ \frac{\partial u_\alpha^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial u_\beta^{(2)}}{\partial x_\alpha^{(2)}}-\frac{\partial h_\alpha^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial h_\beta^{(2)}}{\partial x_\alpha^{(2)}}\ \right]$$

$$\times \frac{d\overline{x}'''}{\left|\overline{x}'''-\overline{x}'\right|}\frac{\partial}{\partial v_{\alpha}^{(2)}}\delta\left(u^{(2)}-v^{(2)}\right)\rangle$$

$$+\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$

$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times \nu\nabla^{2}u_{\alpha}^{(2)}\frac{\partial}{\partial v_{\alpha}^{(2)}}\delta\left(u^{(2)}-v^{(2)}\right)\rangle$$

$$+\langle\ \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$

$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times\frac{\partial h_{\alpha}^{(2)}u_{\beta}^{(2)}}{\partial x_{\beta}^{(2)}}\frac{\partial}{\partial g_{\alpha}^{(2)}}\delta\left(h^{(2)}-g^{(2)}\right)\rangle$$

$$+\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$

$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times\frac{\partial u_{\alpha}^{(2)}h_{\beta}^{(2)}}{\partial x_{\beta}^{(2)}}\frac{\partial}{\partial g_{\alpha}^{(2)}}\delta\left(h^{(2)}-g^{(2)}\right)\rangle$$

$$+\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$

$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times\lambda\nabla^{2}h_{\alpha}^{(2)}\frac{\partial}{\partial g_{\alpha}^{(2)}}\delta\left(h^{(2)}-g^{(2)}\right)\rangle$$

$$+\langle\ \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$

$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times u_{\beta}^{(2)}\frac{\partial\theta^{(2)}}{\partial x_{\beta}^{(2)}}\frac{\partial}{\partial\phi^{(2)}}\delta\left(\theta^{(2)}-\phi^{(2)}\right)\rangle$$

$$+\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$

$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times\gamma\nabla^{2}\theta^{(2)}\frac{\partial}{\partial\phi^{(2)}}\delta\left(\theta^{(2)}-\phi^{(2)}\right)\rangle$$

$$+\langle\ \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$

$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times u_{\beta}^{(2)}\frac{\partial c^{(2)}}{\partial x_{\beta}^{(2)}}\frac{\partial}{\partial\psi^{(2)}}\delta\left(c^{(2)}-\psi^{(2)}\right)\rangle$$

$$+\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$

$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times D\nabla^{2}c^{(2)}\frac{\partial}{\partial\psi^{(2)}}\delta\left(c^{(2)}-\psi^{(2)}\right)\rangle$$

$$+\langle\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$

$$\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times\frac{\partial u_{\alpha}^{(3)}u_{\beta}^{(3)}}{\partial x_{\beta}^{(3)}}\frac{\partial}{\partial v_{\alpha}^{(3)}}\delta\left(u^{(3)}-v^{(3)}\right)\rangle$$

$$+\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$

$$\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times\frac{\partial h_{\alpha}^{(3)}h_{\beta}^{(3)}}{\partial x_{\beta}^{(3)}}\frac{\partial}{\partial v_{\alpha}^{(3)}}\delta\left(u^{(3)}-v^{(3)}\right)\rangle$$

$$+\langle\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$

$$\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times\frac{1}{4\pi}\frac{\partial}{\partial x_{\alpha}^{(3)}}\int\left[\ \frac{\partial u_{\alpha}^{(3)}}{\partial x_{\beta}^{(3)}}\frac{\partial u_{\beta}^{(3)}}{\partial x_{\alpha}^{(3)}}-\frac{\partial h_{\alpha}^{(3)}}{\partial x_{\beta}^{(3)}}\frac{\partial h_{\beta}^{(3)}}{\partial x_{\alpha}^{(3)}}\ \right]$$

$$\times \frac{d\bar{x}'''}{|\bar{x}''' - \bar{x}''|} \frac{\partial}{\partial v_\alpha^{(3)}} \delta\left(u^{(3)} - v^{(3)}\right) \rangle$$
$$+ \langle -\delta\left(u^{(1)} - v^{(1)}\right)\delta\left(h^{(1)} - g^{(1)}\right)\delta\left(\theta^{(1)} - \phi^{(1)}\right)\delta\left(c^{(1)} - \psi^{(1)}\right)\delta\left(u^{(2)} - v^{(2)}\right)\delta\left(h^{(2)} - g^{(2)}\right)\delta\left(\theta^{(2)} - \phi^{(2)}\right)$$
$$\delta\left(c^{(2)} - \psi^{(2)}\right)\delta\left(h^{(3)} - g^{(3)}\right)\delta\left(\theta^{(3)} - \phi^{(3)}\right)\delta\left(c^{(3)} - \psi^{(3)}\right) \times \nu\nabla^2 u_\alpha^{(3)} \frac{\partial}{\partial v_\alpha^{(3)}} \delta\left(u^{(3)} - v^{(3)}\right) \rangle$$

$$+ \langle \ \delta\left(u^{(1)} - v^{(1)}\right)\delta\left(h^{(1)} - g^{(1)}\right)\delta\left(\theta^{(1)} - \phi^{(1)}\right)\delta\left(c^{(1)} - \psi^{(1)}\right)\delta\left(u^{(2)} - v^{(2)}\right)\delta\left(h^{(2)} - g^{(2)}\right)\delta\left(\theta^{(2)} - \phi^{(2)}\right)$$
$$\delta\left(c^{(2)} - \psi^{(2)}\right)\delta\left(u^{(3)} - v^{(3)}\right)\delta\left(\theta^{(3)} - \phi^{(3)}\right)\delta\left(c^{(3)} - \psi^{(3)}\right) \times \frac{\partial h_\alpha^{(3)} u_\beta^{(3)}}{\partial x_\beta^{(3)}} \frac{\partial}{\partial g_\alpha^{(3)}} \delta\left(h^{(3)} - g^{(3)}\right) \rangle$$

$$+ \langle -\delta\left(u^{(1)} - v^{(1)}\right)\delta\left(h^{(1)} - g^{(1)}\right)\delta\left(\theta^{(1)} - \phi^{(1)}\right)\delta\left(c^{(1)} - \psi^{(1)}\right)\delta\left(u^{(2)} - v^{(2)}\right)\delta\left(h^{(2)} - g^{(2)}\right)\delta\left(\theta^{(2)} - \phi^{(2)}\right)$$
$$\delta\left(c^{(2)} - \psi^{(2)}\right)\delta\left(u^{(3)} - v^{(3)}\right)\delta\left(\theta^{(3)} - \phi^{(3)}\right)\delta\left(c^{(3)} - \psi^{(3)}\right) \times \frac{\partial u_\alpha^{(3)} h_\beta^{(3)}}{\partial x_\beta^{(3)}} \frac{\partial}{\partial g_\alpha^{(3)}} \delta\left(h^{(3)} - g^{(3)}\right) \rangle$$
$$+ \langle -\delta\left(u^{(1)} - v^{(1)}\right)\delta\left(h^{(1)} - g^{(1)}\right)\delta\left(\theta^{(1)} - \phi^{(1)}\right)\delta\left(c^{(1)} - \psi^{(1)}\right)\delta\left(u^{(2)} - v^{(2)}\right)\delta\left(h^{(2)} - g^{(2)}\right)\delta\left(\theta^{(2)} - \phi^{(2)}\right)$$
$$\delta\left(c^{(2)} - \psi^{(2)}\right)\delta\left(u^{(3)} - v^{(3)}\right)\delta\left(\theta^{(3)} - \phi^{(3)}\right)\delta\left(c^{(3)} - \psi^{(3)}\right) \times \lambda\nabla^2 h_\alpha^{(3)} \frac{\partial}{\partial g_\alpha^{(3)}} \delta\left(h^{(3)} - g^{(3)}\right) \rangle$$
$$+ \langle \ \delta\left(u^{(1)} - v^{(1)}\right)\delta\left(h^{(1)} - g^{(1)}\right)\delta\left(\theta^{(1)} - \phi^{(1)}\right)\delta\left(c^{(1)} - \psi^{(1)}\right)\delta\left(u^{(2)} - v^{(2)}\right)\delta\left(h^{(2)} - g^{(2)}\right)\delta\left(\theta^{(2)} - \phi^{(2)}\right)$$
$$\delta\left(c^{(2)} - \psi^{(2)}\right)\delta\left(u^{(3)} - v^{(3)}\right)\delta\left(h^{(3)} - g^{(3)}\right)\delta\left(c^{(3)} - \psi^{(3)}\right) \times u_\beta^{(3)} \frac{\partial \theta^{(3)}}{\partial x_\beta^{(3)}} \frac{\partial}{\partial \phi^{(3)}} \delta\left(\theta^{(3)} - \phi^{(3)}\right) \rangle$$
$$+ \langle -\delta\left(u^{(1)} - v^{(1)}\right)\delta\left(h^{(1)} - g^{(1)}\right)\delta\left(\theta^{(1)} - \phi^{(1)}\right)\delta\left(c^{(1)} - \psi^{(1)}\right)\delta\left(u^{(2)} - v^{(2)}\right)\delta\left(h^{(2)} - g^{(2)}\right)\delta\left(\theta^{(2)} - \phi^{(2)}\right)$$
$$\delta\left(c^{(2)} - \psi^{(2)}\right)\delta\left(u^{(3)} - v^{(3)}\right)\delta\left(h^{(3)} - g^{(3)}\right)\delta\left(c^{(3)} - \psi^{(3)}\right) \times \gamma\nabla^2 \theta^{(3)} \frac{\partial}{\partial \phi^{(3)}} \delta\left(\theta^{(3)} - \phi^{(3)}\right) \rangle$$
$$+ \langle \ \delta\left(u^{(1)} - v^{(1)}\right)\delta\left(h^{(1)} - g^{(1)}\right)\delta\left(\theta^{(1)} - \phi^{(1)}\right)\delta\left(c^{(1)} - \psi^{(1)}\right)\delta\left(u^{(2)} - v^{(2)}\right)\delta\left(h^{(2)} - g^{(2)}\right)\delta\left(\theta^{(2)} - \phi^{(2)}\right)$$
$$\delta\left(c^{(2)} - \psi^{(2)}\right)\delta\left(u^{(3)} - v^{(3)}\right)\delta\left(h^{(3)} - g^{(3)}\right)\delta\left(\theta^{(3)} - \phi^{(3)}\right) \times u_\beta^{(3)} \frac{\partial c^{(3)}}{\partial x_\beta^{(3)}} \frac{\partial}{\partial \psi^{(3)}} \delta\left(c^{(3)} - \psi^{(3)}\right) \rangle$$

$$+ \langle -\delta\left(u^{(1)} - v^{(1)}\right)\delta\left(h^{(1)} - g^{(1)}\right)\delta\left(\theta^{(1)} - \phi^{(1)}\right)\delta\left(c^{(1)} - \psi^{(1)}\right)\delta\left(u^{(2)} - v^{(2)}\right)\delta\left(h^{(2)} - g^{(2)}\right)\delta\left(\theta^{(2)} - \phi^{(2)}\right)$$
$$\delta\left(u^{(3)} - v^{(3)}\right)\delta\left(h^{(3)} - g^{(3)}\right)\delta\left(\theta^{(3)} - \phi^{(3)}\right) \times D\nabla^2 c^{(3)} \frac{\partial}{\partial \psi^{(3)}} \delta\left(c^{(3)} - \psi^{(3)}\right) \rangle \tag{64}$$

Various terms in the above equation can be simplified as that they may be expressed in terms of one, two, three and four point distribution functions.

The 1st term in the above equation is simplified as follows:

$$\langle \ \delta\left(h^{(1)} - g^{(1)}\right)\delta\left(\theta^{(1)} - \phi^{(1)}\right)\delta\left(c^{(1)} - \psi^{(1)}\right)\delta\left(u^{(2)} - v^{(2)}\right)\delta\left(h^{(2)} - g^{(2)}\right)\delta\left(\theta^{(2)} - \phi^{(2)}\right)\delta\left(c^{(2)} - \psi^{(2)}\right)$$
$$\delta\left(u^{(3)} - v^{(3)}\right)\delta\left(h^{(3)} - g^{(3)}\right)\delta\left(\theta^{(3)} - \phi^{(3)}\right)\delta\left(c^{(3)} - \psi^{(3)}\right) \times \frac{\partial u_\alpha^{(1)} u_\beta^{(1)}}{\partial x_\beta^{(1)}} \frac{\partial}{\partial v_\alpha^{(1)}} \delta\left(u^{(1)} - v^{(1)}\right) \rangle$$
$$= \langle u_\beta^{(1)} \delta\left(h^{(1)} - g^{(1)}\right)\delta\left(\theta^{(1)} - \phi^{(1)}\right)\delta\left(c^{(1)} - \psi^{(1)}\right)\delta\left(u^{(2)} - v^{(2)}\right)\delta\left(h^{(2)} - g^{(2)}\right)\delta\left(\theta^{(2)} - \phi^{(2)}\right)\delta\left(c^{(2)} - \psi^{(2)}\right)$$
$$\delta\left(u^{(3)} - v^{(3)}\right)\delta\left(h^{(3)} - g^{(3)}\right)\delta\left(\theta^{(3)} - \phi^{(3)}\right)\delta\left(c^{(3)} - \psi^{(3)}\right) \times \frac{\partial u_\alpha^{(1)}}{\partial x_\beta^{(1)}} \frac{\partial}{\partial v_\alpha^{(1)}} \delta\left(u^{(1)} - v^{(1)}\right) \rangle$$

$$=\Big\langle -u_{\beta}^{(1)}\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times\frac{\partial u_{\alpha}^{(1)}}{\partial v_{\alpha}^{(1)}}\frac{\partial}{\partial x_{\beta}^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\Big\rangle;\text{(since }\frac{\partial u_{\alpha}^{(1)}}{\partial v_{\alpha}^{(1)}}=1)$$

$$=\Big\langle -\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times u_{\beta}^{(1)}\frac{\partial}{\partial x_{\beta}^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\Big\rangle \tag{65}$$

Similarly, fifth, eighth and tenth terms of right hand-sides of Eq. (64) can be simplified as follows:

$$\Big\langle\ \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times\frac{\partial h_{\alpha}^{(1)}u_{\beta}^{(1)}}{\partial x_{\beta}^{(1)}}\frac{\partial}{\partial g_{\alpha}^{(1)}}\delta\left(h^{(1)}-g^{(1)}\right)\Big\rangle$$

$$=\Big\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times u_{\beta}^{(1)}\frac{\partial}{\partial x_{\beta}^{(1)}}\delta\left(h^{(1)}-g^{(1)}\right)\Big\rangle \tag{66}$$

Eighth term:

$$\Big\langle\ \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times u_{\beta}^{(1)}\frac{\partial\theta^{(1)}}{\partial x_{\beta}^{(1)}}\frac{\partial}{\partial\phi^{(1)}}\delta\left(\theta^{(1)}-\phi^{(1)}\right)\Big\rangle$$

$$=\Big\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times u_{\beta}^{(1)}\frac{\partial}{\partial x_{\beta}^{(1)}}\delta\left(\theta^{(1)}-\phi^{(1)}\right)\Big\rangle \tag{67}$$

And tenth term:

$$\Big\langle\ \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times u_{\beta}^{(1)}\frac{\partial c^{(1)}}{\partial x_{\beta}^{(1)}}\frac{\partial}{\partial\psi^{(1)}}\delta\left(c^{(1)}-\psi^{(1)}\right)\Big\rangle$$

$$=\Big\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times u_{\beta}^{(1)}\frac{\partial}{\partial x_{\beta}^{(1)}}\delta\left(c^{(1)}-\psi^{(1)}\right)\Big\rangle. \tag{68}$$

Adding these equations from (66) to (68), we get:

$$\Big\langle -\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times u_{\beta}^{(1)}\frac{\partial}{\partial x_{\beta}^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\Big\rangle$$

$$+\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times u_\beta^{(1)}\frac{\partial}{\partial x_\beta^{(1)}}\delta\left(h^{(1)}-g^{(1)}\right)\rangle$$
$$+\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times u_\beta^{(1)}\frac{\partial}{\partial x_\beta^{(1)}}\delta\left(\theta^{(1)}-\phi^{(1)}\right)\rangle$$
$$+\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times u_\beta^{(1)}\frac{\partial}{\partial x_\beta^{(1)}}\delta\left(c^{(1)}-\psi^{(1)}\right)\rangle$$
$$=-\frac{\partial}{\partial x_\beta^{(1)}}\langle u_\beta^{(1)}\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)$$
$$\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\rangle$$

$=-\frac{\partial}{\partial x_\beta^{(1)}}v_\beta^{(1)}F_3^{(1,2,3)}$ (Applying the properties of distribution functions):

$$=-v_\beta^{(1)}\frac{\partial F_3^{(1,2,3)}}{\partial x_\beta^{(1)}} \tag{69}$$

Similarly, 12th, 16th, 19th and 21st terms of right hand-side of Eq. (64) can be simplified as follows:

$$\langle\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times\frac{\partial u_\alpha^{(2)}u_\beta^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial}{\partial v_\alpha^{(2)}}\delta\left(u^{(2)}-v^{(2)}\right)\rangle$$
$$=\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times u_\beta^{(2)}\frac{\partial}{\partial x_\beta^{(2)}}\delta\left(u^{(2)}-v^{(2)}\right)\rangle \tag{70}$$

16th term:

$$\langle\ \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times\frac{\partial h_\alpha^{(2)}u_\beta^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial}{\partial g_\alpha^{(2)}}\delta\left(h^{(2)}-g^{(2)}\right)\rangle$$
$$=\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times u_\beta^{(2)}\frac{\partial}{\partial x_\beta^{(2)}}\delta\left(h^{(2)}-g^{(2)}\right)\rangle \tag{71}$$

19th term:

$$\langle\ \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times u_\beta^{(2)}\frac{\partial\theta^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial}{\partial\phi^{(2)}}\delta\left(\theta^{(2)}-\phi^{(2)}\right)\rangle$$

And 21st term:

$$=\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times u_{\beta}^{(2)}\frac{\partial}{\partial x_{\beta}^{(2)}}\delta\left(\theta^{(2)}-\phi^{(2)}\right)\rangle \tag{72}$$

$$\langle\ \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times u_{\beta}^{(2)}\frac{\partial c^{(2)}}{\partial x_{\beta}^{(2)}}\frac{\partial}{\partial \psi^{(2)}}\delta\left(c^{(2)}-\psi^{(2)}\right)\rangle$$

$$=\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times u_{\beta}^{(2)}\frac{\partial}{\partial x_{\beta}^{(2)}}\delta\left(c^{(2)}-\psi^{(2)}\right)\rangle \tag{73}$$

Adding these equations from (70) to (73), we get:

$$-\frac{\partial}{\partial x_{\beta}^{(2)}}\langle u_{\beta}^{(2)}\langle\ \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)$$
$$\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\rangle$$

$$=-v_{\beta}^{(2)}\frac{\partial F_{3}^{(1,2,3)}}{\partial x_{\beta}^{(2)}} \tag{74}$$

Similarly, 23rd, 27th, 30th and 32nd terms of right hand-side of Eq. (64) can be simplified as follows:

$$\langle\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$
$$\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times\frac{\partial u_{\alpha}^{(3)}u_{\beta}^{(3)}}{\partial x_{\beta}^{(3)}}\frac{\partial}{\partial v_{\alpha}^{(2)}}\delta\left(u^{(3)}-v^{(3)}\right)\rangle$$

$$=\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$
$$\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times u_{\beta}^{(3)}\frac{\partial}{\partial x_{\beta}^{(3)}}\delta\left(u^{(3)}-v^{(3)}\right)\rangle \tag{75}$$

27th term:

$$\langle\ \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$
$$\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times\frac{\partial h_{\alpha}^{(3)}u_{\beta}^{(3)}}{\partial x_{\beta}^{(3)}}\frac{\partial}{\partial g_{\alpha}^{(3)}}\delta\left(h^{(3)}-g^{(3)}\right)\rangle$$

$$=\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$
$$\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times u_{\beta}^{(3)}\frac{\partial}{\partial x_{\beta}^{(3)}}\delta\left(h^{(3)}-g^{(3)}\right)\rangle \tag{76}$$

30th term:

$$\langle\ \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$
$$\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times u_\beta^{(3)}\frac{\partial\theta^{(3)}}{\partial x_\beta^{(3)}}\frac{\partial}{\partial\phi^{(3)}}\delta\left(\theta^{(3)}-\phi^{(3)}\right)\ \rangle$$

$$=\langle-\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$
$$\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times u_\beta^{(3)}\frac{\partial}{\partial x_\beta^{(3)}}\delta\left(\theta^{(3)}-\phi^{(3)}\right)\ \rangle \tag{77}$$

And 32nd term:

$$\langle\ \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$
$$\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\times u_\beta^{(3)}\frac{\partial c^{(3)}}{\partial x_\beta^{(3)}}\frac{\partial}{\partial\psi^{(3)}}\delta\left(c^{(3)}-\psi^{(3)}\right)\ \rangle$$

$$=\langle-\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$
$$\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\times u_\beta^{(3)}\frac{\partial}{\partial x_\beta^{(3)}}\delta\left(c^{(3)}-\psi^{(3)}\right)\ \rangle. \tag{78}$$

Adding these equations from (75) to (78), we get:

$$-\frac{\partial}{\partial x_\beta^{(3)}}\langle u_\beta^{(3)}\langle-\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)$$
$$\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\ \rangle$$

$$=-v_\beta^{(3)}\frac{\partial F_3^{(1,2,3)}}{\partial x_\beta^{(3)}} \tag{79}$$

Similarly, 2nd, 6th, 13th, 17th, 24th and 28th terms of right hand-side of Eq. (74) can be simplified as follows:

$$\langle-\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times\frac{\partial h_\alpha^{(1)}h_\beta^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial v_\alpha^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\ \rangle$$

$$=-\,g_\beta^{(1)}\frac{\partial g_\alpha^{(1)}}{\partial v_\alpha^{(1)}}\frac{\partial F_3^{(1,2,3)}}{\partial x_\beta^{(1)}} \tag{80}$$

6th term:

$$\langle-\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times\frac{\partial u_\alpha^{(1)}h_\beta^{(1)}}{\partial x_\beta^{(1)}}\frac{\partial}{\partial g_\alpha}\delta\left(h^{(1)}-g^{(1)}\right)\rangle$$
$$=-\,g_\beta^{(1)}\frac{\partial v_\alpha^{(1)}}{\partial g_\alpha^{(1)}}\frac{\partial F_3^{(1,2,3)}}{\partial x_\beta^{(1)}} \tag{81}$$

13th term:

$$\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$

$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times\frac{\partial h_\alpha^{(2)}h_\beta^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial}{\partial v_\alpha^{(2)}}\delta\left(u^{(2)}-v^{(2)}\right)\rangle$$

$$= - g_\beta^{(2)}\frac{\partial g_\alpha^{(2)}}{\partial v_\alpha^{(2)}}\frac{\partial F_3^{(1,2,3)}}{\partial x_\beta^{(2)}} \tag{82}$$

17th term:

$$\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$

$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times\frac{\partial u_\alpha^{(2)}h_\beta^{(2)}}{\partial x_\beta^{(2)}}\frac{\partial}{\partial g_\alpha^{(2)}}\delta\left(h^{(2)}-g^{(2)}\right)\rangle$$

$$=- g_\beta^{(2)}\frac{\partial v_\alpha^{(2)}}{\partial g_\alpha^{(2)}}\frac{\partial F_3^{(1,2,3)}}{\partial x_\beta^{(2)}} \tag{83}$$

24th term:

$$\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$

$$\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times\frac{\partial h_\alpha^{(3)}h_\beta^{(3)}}{\partial x_\beta^{(3)}}\frac{\partial}{\partial v_\alpha^{(3)}}\delta\left(u^{(3)}-v^{(3)}\right)\rangle$$

$$= - g_\beta^{(3)}\frac{\partial g_\alpha^{(3)}}{\partial v_\alpha^{(3)}}\frac{\partial F_3^{(1,2,3)}}{\partial x_\beta^{(3)}} \tag{84}$$

And 28th term:

$$\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$

$$\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times\frac{\partial u_\alpha^{(3)}h_\beta^{(3)}}{\partial x_\beta^{(3)}}\frac{\partial}{\partial g_\alpha^{(3)}}\delta\left(h^{(3)}-g^{(3)}\right)\rangle$$

$$= - g_\beta^{(3)}\frac{\partial v_\alpha^{(3)}}{\partial g_\alpha^{(3)}}\frac{\partial F_3^{(1,2,3)}}{\partial x_\beta^{(3)}} \tag{85}$$

Fourth term can be reduced:

$$\langle -\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$

$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times\nu\nabla^2 u_\alpha^{(1)}\frac{\partial}{\partial v_\alpha^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)$$

$$= -\nu\frac{\partial}{\partial v_\alpha^{(1)}}\langle\nabla^2 u_\alpha^{(1)}[\ \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)$$

$$\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\ ]\ \rangle$$

$$= -\nu\frac{\partial}{\partial v_\alpha^{(1)}}\frac{\partial^2}{\partial x_\beta^{(1)}\partial x_\beta^{(1)}}\langle u_\alpha^{(1)}[\ \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)$$

$$\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\ ]\ \rangle$$

$$= -\nu \frac{\partial}{\partial v_\alpha^{(1)}} \lim_{\bar{x}^{(4)} \to \bar{x}^{(1)}} \frac{\partial^2}{\partial x_\beta^{(4)} \partial x_\beta^{(4)}} \langle u_\alpha^{(4)} [\ \delta(u^{(1)} - v^{(1)}) \delta(h^{(1)} - g^{(1)}) \delta(\theta^{(1)} - \phi^{(1)}) \delta(c^{(1)} - \psi^{(1)})$$

$$\delta(u^{(2)} - v^{(2)}) \delta(h^{(2)} - g^{(2)}) \delta(\theta^{(2)} - \phi^{(2)}) \delta(c^{(2)} - \psi^{(2)}) \delta(u^{(3)} - v^{(3)}) \delta(h^{(3)} - g^{(3)})$$
$$\delta(\theta^{(3)} - \phi^{(3)}) \delta(c^{(3)} - \psi^{(3)})\ ]\ \rangle$$

$$= -\nu \frac{\partial}{\partial v_\alpha^{(1)}} \lim_{\bar{x}^{(4)} \to \bar{x}^{(1)}} \frac{\partial^2}{\partial x_\beta^{(4)} \partial x_\beta^{(4)}} \langle \int\ u_\alpha^{(4)} \delta(u^{(4)} - v^{(4)}) \delta(h^{(4)} - g^{(4)}) \delta(\theta^{(4)} - \phi^{(4)}) \delta(c^{(4)} - \psi^{(4)})$$

$$\delta(u^{(3)} - v^{(3)}) \delta(h^{(3)} - g^{(3)}) \delta(\theta^{(3)} - \phi^{(3)}) \delta(c^{(3)} - \psi^{(3)}) \delta(u^{(2)} - v^{(2)}) \delta(h^{(2)} - g^{(2)}) \delta(\theta^{(2)} - \phi^{(2)})$$

$$\delta(c^{(2)} - \psi^{(2)}) \delta(u^{(1)} - v^{(1)}) \delta(h^{(1)} - g^{(1)}) \delta(\theta^{(1)} - \phi^{(1)}) \delta(c^{(1)} - \psi^{(1)}) dv^{(4)} dg^{(4)} d\phi^{(4)} d\psi^{(4)}\ \rangle$$

$$= -\nu \frac{\partial}{\partial v_\alpha^{(1)}} \lim_{\bar{x}^{(4)} \to \bar{x}^{(1)}} \frac{\partial^2}{\partial x_\beta^{(4)} \partial x_\beta^{(4)}} \int v_\alpha^{(4)} F_4^{(1,2,3,4)} dv^{(4)} dg^{(4)} d\phi^{(4)} d\psi^{(4)} \tag{86}$$

Similarly, $7^{th}$, $9^{th}$, $11^{th}$, $15^{th}$, $18^{th}$, $20^{th}$, $22^{nd}$, $26^{th}$, $29^{th}$, $31^{st}$ and $33^{rd}$ terms of right hand-side of Eq. (74) can be simplified as follows:

$$\langle -\delta(u^{(1)} - v^{(1)}) \delta(\theta^{(1)} - \phi^{(1)}) \delta(c^{(1)} - \psi^{(1)}) \delta(u^{(2)} - v^{(2)}) \delta(h^{(2)} - g^{(2)}) \delta(\theta^{(2)} - \phi^{(2)}) \delta(c^{(2)} - \psi^{(2)})$$
$$\delta(u^{(3)} - v^{(3)}) \delta(h^{(3)} - g^{(3)}) \delta(\theta^{(3)} - \phi^{(3)}) \delta(c^{(3)} - \psi^{(3)}) \times \lambda \nabla^2 h_\alpha^{(1)} \frac{\partial}{\partial g_\alpha^{(1)}} \delta(h^{(1)} - g^{(1)})\ \rangle$$

$$= -\lambda \frac{\partial}{\partial g_\alpha^{(1)}} \lim_{\bar{x}^{(4)} \to \bar{x}^{(1)}} \frac{\partial^2}{\partial x_\beta^{(4)} \partial x_\beta^{(4)}} \int g_\alpha^{(4)} F_4^{(1,2,3,4)} dv^{(4)} dg^{(4)} d\phi^{(4)} d\psi^{(4)} \tag{87}$$

$9^{th}$ term:

$$\langle -\delta(u^{(1)} - v^{(1)}) \delta(h^{(1)} - g^{(1)}) \delta(c^{(1)} - \psi^{(1)}) \delta(u^{(2)} - v^{(2)}) \delta(h^{(2)} - g^{(2)}) \delta(\theta^{(2)} - \phi^{(2)}) \delta(c^{(2)} - \psi^{(2)})$$
$$\delta(u^{(3)} - v^{(3)}) \delta(h^{(3)} - g^{(3)}) \delta(\theta^{(3)} - \phi^{(3)}) \delta(c^{(3)} - \psi^{(3)}) \times \gamma \nabla^2 \theta^{(1)} \frac{\partial}{\partial \phi^{(1)}} \delta(\theta^{(1)} - \phi^{(1)})\ \rangle$$

$$= -\gamma \frac{\partial}{\partial \phi^{(1)}} \lim_{\bar{x}^{(4)} \to \bar{x}^{(1)}} \frac{\partial^2}{\partial x_\beta^{(4)} \partial x_\beta^{(4)}} \int \phi^{(4)} F_4^{(1,2,3,4)} dv^{(4)} dg^{(4)} d\phi^{(4)} d\psi^{(4)} \tag{88}$$

$11^{th}$ term:

$$\langle -\delta(u^{(1)} - v^{(1)}) \delta(h^{(1)} - g^{(1)}) \delta(\theta^{(1)} - \phi^{(1)}) \delta(u^{(2)} - v^{(2)}) \delta(h^{(2)} - g^{(2)}) \delta(\theta^{(2)} - \phi^{(2)}) \delta(c^{(2)} - \psi^{(2)})$$
$$\delta(u^{(3)} - v^{(3)}) \delta(h^{(3)} - g^{(3)}) \delta(\theta^{(3)} - \phi^{(3)}) \delta(c^{(3)} - \psi^{(3)}) \times D \nabla^2 c^{(1)} \frac{\partial}{\partial \psi^{(1)}} \delta(c^{(1)} - \psi^{(1)})\ \rangle$$

$$= -D \frac{\partial}{\partial \psi^{(1)}} \lim_{\bar{x}^{(4)} \to \bar{x}^{(1)}} \frac{\partial^2}{\partial x_\beta^{(4)} \partial x_\beta^{(3)}} \int \psi^{(4)} F_4^{(1,2,3,4)} dv^{(4)} dg^{(4)} d\phi^{(4)} d\psi^{(4)} \tag{89}$$

$15^{th}$ term:

$$\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times \nu\nabla^2 u_\alpha^{(2)}\frac{\partial}{\partial v_\alpha^{(2)}}\delta\left(u^{(2)}-v^{(2)}\right)\rangle$$
$$=-\nu\frac{\partial}{\partial v_\alpha^{(2)}}\lim_{\bar{x}^{(4)}\to\bar{x}^{(2)}}\frac{\partial^2}{\partial x_\beta^{(4)}\partial x_\beta^{(4)}}\int v_\alpha^{(4)}F_4^{(1,2,3,4)}dv^{(4)}dg^{(4)}d\phi^{(4)}d\psi^{(4)} \tag{90}$$

18th term:

$$\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times \lambda\nabla^2 h_\alpha^{(2)}\frac{\partial}{\partial g_\alpha^{(2)}}\delta\left(h^{(2)}-g^{(2)}\right)\rangle$$
$$=-\lambda\frac{\partial}{\partial g_\alpha^{(2)}}\lim_{\bar{x}^{(4)}\to\bar{x}^{(2)}}\frac{\partial^2}{\partial x_\beta^{(4)}\partial x_\beta^{(4)}}\int g_\alpha^{(4)}F_4^{(1,2,3,4)}dv^{(4)}dg^{(4)}d\phi^{(4)}d\psi^{(4)} \tag{91}$$

20th term:

$$\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times \gamma\nabla^2 \theta^{(2)}\frac{\partial}{\partial \phi^{(2)}}\delta\left(\theta^{(2)}-\phi^{(2)}\right)\rangle$$
$$=-\gamma\frac{\partial}{\partial \phi^{(2)}}\lim_{\bar{x}^{(4)}\to\bar{x}^{(2)}}\frac{\partial^2}{\partial x_\beta^{(4)}\partial x_\beta^{(4)}}\int \phi^{(4)}F_4^{(1,2,3,4)}dv^{(4)}dg^{(4)}d\phi^{(4)}d\psi^{(4)} \tag{92}$$

22nd term:

$$\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times D\nabla^2 c^{(2)}\frac{\partial}{\partial \psi^{(2)}}\delta\left(c^{(2)}-\psi^{(2)}\right)\rangle$$
$$=-D\frac{\partial}{\partial \psi^{(2)}}\lim_{\bar{x}^{(4)}\to\bar{x}^{(2)}}\frac{\partial^2}{\partial x_\beta^{(4)}\partial x_\beta^{(4)}}\int \psi^{(4)}F_4^{(1,2,3,4)}dv^{(4)}dg^{(4)}d\phi^{(4)}d\psi^{(4)} \tag{93}$$

26th term:

$$\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$
$$\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times \nu\nabla^2 u_\alpha^{(3)}\frac{\partial}{\partial v_\alpha^{(3)}}\delta\left(u^{(3)}-v^{(3)}\right)\rangle$$
$$=-\nu\frac{\partial}{\partial v_\alpha^{(3)}}\lim_{\bar{x}^{(4)}\to\bar{x}^{(3)}}\frac{\partial^2}{\partial x_\beta^{(4)}\partial x_\beta^{(4)}}\int v_\alpha^{(4)}F_4^{(1,2,3,4)}dv^{(4)}dg^{(4)}d\phi^{(4)}d\psi^{(4)} \tag{94}$$

29th term:

$$\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$
$$\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times \lambda\nabla^2 h_\alpha^{(3)}\frac{\partial}{\partial g_\alpha^{(3)}}\delta\left(h^{(3)}-g^{(3)}\right)\rangle$$

$$=-\lambda\frac{\partial}{\partial g_{\alpha}^{(3)}}\lim_{\bar{x}^{(4)}\to\bar{x}^{(3)}}\frac{\partial^2}{\partial x_{\beta}^{(4)}\partial x_{\beta}^{(4)}}\int g_{\alpha}^{(4)}F_4^{(1,2,3,4)}dv^{(4)}dg^{(4)}d\phi^{(4)}d\psi^{(4)} \tag{95}$$

31[st] term:

$$\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$
$$\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times\gamma\nabla^2\theta^{(3)}\frac{\partial}{\partial\phi^{(3)}}\delta\left(\theta^{(3)}-\phi^{(3)}\right)\rangle$$

$$=-\gamma\frac{\partial}{\partial\phi^{(3)}}\lim_{\bar{x}^{(4)}\to\bar{x}^{(3)}}\frac{\partial^2}{\partial x_{\beta}^{(4)}\partial x_{\beta}^{(4)}}\int\phi^{(4)}F_4^{(1,2,3,4)}dv^{(4)}dg^{(4)}d\phi^{(4)}d\psi^{(4)} \tag{96}$$

33[rd] term:

$$\langle -\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$
$$\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\times D\nabla^2 c^{(3)}\frac{\partial}{\partial\psi^{(3)}}\delta\left(c^{(3)}-\psi^{(3)}\right)\rangle$$

$$=-D\frac{\partial}{\partial\psi^{(3)}}\lim_{\bar{x}^{(4)}\to\bar{x}^{(3)}}\frac{\partial^2}{\partial x_{\beta}^{(4)}\partial x_{\beta}^{(4)}}\int\psi^{(4)}F_4^{(1,2,3,4)}dv^{(4)}dg^{(4)}d\phi^{(4)}d\psi^{(4)} \tag{97}$$

We reduce the third term of right hand side of Eq. (64):

$$\langle\ \delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(u^{(3)}-v^{(3)}\right)$$
$$\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times\frac{1}{4\pi}\frac{\partial}{\partial x_{\alpha}^{(1)}}\int\left[\ \frac{\partial u_{\alpha}^{(1)}}{\partial x_{\beta}^{(1)}}\frac{\partial u_{\beta}^{(1)}}{\partial x_{\alpha}^{(1)}}-\frac{\partial h_{\alpha}^{(1)}}{\partial x_{\beta}^{(1)}}\frac{\partial h_{\beta}^{(1)}}{\partial x_{\alpha}^{(1)}}\ \right]\frac{d\bar{x}'''}{\left|\bar{x}'''-\bar{x}\right|}\frac{\partial}{\partial v_{\alpha}^{(1)}}\delta\left(u^{(1)}-v^{(1)}\right)\rangle$$

$$=\frac{\partial}{\partial v_{\alpha}^{(1)}}\left[\ \frac{1}{4\pi}\int\ \frac{\partial}{\partial x_{\alpha}^{(1)}}\left(\ \frac{1}{\left|\bar{x}^{(4)}-\bar{x}^{(1)}\right|}\ \right)\left(\ \frac{\partial v_{\alpha}^{(4)}}{\partial x_{\beta}^{(4)}}\frac{\partial v_{\beta}^{(4)}}{\partial x_{\alpha}^{(4)}}-\frac{\partial g_{\alpha}^{(4)}}{\partial x_{\beta}^{(4)}}\frac{\partial g_{\beta}^{(4)}}{\partial x_{\alpha}^{(4)}}\ \right)F_4^{(1,2,3,4)}dx^{(4)}dv^{(4)}dg^{(4)}d\phi^{(4)}d\psi^{(4)}\ \right] \tag{98}$$

Similarly, 14[th] and 25[th] term:

$$\langle\delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)\delta\left(c^{(2)}-\psi^{(2)}\right)$$
$$\delta\left(u^{(3)}-v^{(3)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)\times\frac{1}{4\pi}\frac{\partial}{\partial x_{\alpha}^{(2)}}\int\left[\ \frac{\partial u_{\alpha}^{(2)}}{\partial x_{\beta}^{(2)}}\frac{\partial u_{\beta}^{(2)}}{\partial x_{\alpha}^{(2)}}-\frac{\partial h_{\alpha}^{(2)}}{\partial x_{\beta}^{(2)}}\frac{\partial h_{\beta}^{(2)}}{\partial x_{\alpha}^{(2)}}\ \right]$$
$$\times\frac{d\bar{x}'''}{\left|\bar{x}'''-\bar{x}'\right|}\frac{\partial}{\partial v_{\alpha}^{(2)}}\delta\left(u^{(2)}-v^{(2)}\right)\rangle$$

$$=\frac{\partial}{\partial v_{\alpha}^{(2)}}\left[\ \frac{1}{4\pi}\int\ \frac{\partial}{\partial x_{\alpha}^{(2)}}\left(\ \frac{1}{\left|\bar{x}^{(4)}-\bar{x}^{(2)}\right|}\ \right)\left(\ \frac{\partial v_{\alpha}^{(4)}}{\partial x_{\beta}^{(4)}}\frac{\partial v_{\beta}^{(4)}}{\partial x_{\alpha}^{(4)}}-\frac{\partial g_{\alpha}^{(4)}}{\partial x_{\beta}^{(4)}}\frac{\partial g_{\beta}^{(4)}}{\partial x_{\alpha}^{(4)}}\ \right)\right.$$
$$\left.F_4^{(1,2,3,4)}dx^{(4)}dv^{(4)}dg^{(4)}d\phi^{(4)}d\psi^{(4)}\ \right] \tag{99}$$

25[th] term:

$$\langle\ \delta\left(u^{(1)}-v^{(1)}\right)\delta\left(h^{(1)}-g^{(1)}\right)\delta\left(\theta^{(1)}-\phi^{(1)}\right)\delta\left(c^{(1)}-\psi^{(1)}\right)\delta\left(u^{(2)}-v^{(2)}\right)\delta\left(h^{(2)}-g^{(2)}\right)\delta\left(\theta^{(2)}-\phi^{(2)}\right)$$
$$\delta\left(c^{(2)}-\psi^{(2)}\right)\delta\left(h^{(3)}-g^{(3)}\right)\delta\left(\theta^{(3)}-\phi^{(3)}\right)\delta\left(c^{(3)}-\psi^{(3)}\right)$$
$$\times\frac{1}{4\pi}\frac{\partial}{\partial x_\alpha^{(3)}}\int\left[\frac{\partial u_\alpha^{(3)}}{\partial x_\beta^{(3)}}\frac{\partial u_\beta^{(3)}}{\partial x_\alpha^{(3)}}-\frac{\partial h_\alpha^{(3)}}{\partial x_\beta^{(3)}}\frac{\partial h_\beta^{(3)}}{\partial x_\alpha^{(3)}}\right]\frac{d\bar{x}'''}{\left|\bar{x}'''-\bar{x}''\right|}\frac{\partial}{\partial v_\alpha^{(3)}}\delta\left(u^{(3)}-v^{(3)}\right)\ \rangle$$

$$=\frac{\partial}{\partial v_\alpha^{(3)}}\left[\frac{1}{4\pi}\int\frac{\partial}{\partial x_\alpha^{(3)}}\left(\frac{1}{\left|\bar{x}^{(4)}-\bar{x}^{(3)}\right|}\right)\left(\frac{\partial v_\alpha^{(4)}}{\partial x_\beta^{(4)}}\frac{\partial v_\beta^{(4)}}{\partial x_\alpha^{(4)}}-\frac{\partial g_\alpha^{(4)}}{\partial x_\beta^{(4)}}\frac{\partial g_\beta^{(4)}}{\partial x_\alpha^{(4)}}\right)\right.$$
$$\left.F_4^{(1,2,3,4)}dx^{(4)}dv^{(4)}dg^{(4)}d\phi^{(4)}d\psi^{(4)}\right]. \tag{100}$$

Substituting the results (65)-(100) in Eq. (64) we get the transport equation for three-point distribution function $F_3^{(1,2,3)}(v,g,\phi,\psi)$ in MHD turbulent flow as:

$$\frac{\partial F_3^{(1,2,3)}}{\partial t}+\left(v_\beta^{(1)}\frac{\partial}{\partial x_\beta^{(1)}}+v_\beta^{(2)}\frac{\partial}{\partial x_\beta^{(2)}}v_\beta^{(3)}\frac{\partial}{\partial x_\beta^{(3)}}\right)F_3^{(1,2,3)}+\left[g_\beta^{(1)}\left(\frac{\partial g_\alpha^{(1)}}{\partial v_\alpha^{(1)}}+\frac{\partial v_\alpha^{(1)}}{\partial g_\alpha^{(1)}}\right)\frac{\partial}{\partial x_\beta^{(1)}}\right.$$

$$\left.+g_\beta^{(2)}\left(\frac{\partial g_\alpha^{(2)}}{\partial v_\alpha^{(2)}}+\frac{\partial v_\alpha^{(2)}}{\partial g_\alpha^{(2)}}\right)\frac{\partial}{\partial x_\beta^{(2)}}+g_\beta^{(3)}\left(\frac{\partial g_\alpha^{(3)}}{\partial v_\alpha^{(3)}}+\frac{\partial v_\alpha^{(3)}}{\partial g_\alpha^{(3)}}\right)\frac{\partial}{\partial x_\beta^{(3)}}\right]F_3^{(1,2,3)}$$

$$+\nu\left(\frac{\partial}{\partial v_\alpha^{(1)}}\lim_{\bar{x}^{(4)}\to\bar{x}^{(1)}}+\frac{\partial}{\partial v_\alpha^{(2)}}\lim_{\bar{x}^{(4)}\to\bar{x}^{(2)}}+\frac{\partial}{\partial v_\alpha^{(3)}}\lim_{\bar{x}^{(4)}\to\bar{x}^{(3)}}\right)$$
$$\times\frac{\partial^2}{\partial x_\beta^{(4)}\partial x_\beta^{(4)}}\int v_\alpha^{(4)}F_4^{(1,2,3,4)}dv^{(4)}dg^{(4)}d\phi^{(4)}d\psi^{(4)}$$

$$+\lambda\left(\frac{\partial}{\partial g_\alpha^{(1)}}\lim_{\bar{x}^{(4)}\to\bar{x}^{(1)}}+\frac{\partial}{\partial g_\alpha^{(2)}}\lim_{\bar{x}^{(4)}\to\bar{x}^{(2)}}+\frac{\partial}{\partial g_\alpha^{(3)}}\lim_{\bar{x}^{(4)}\to\bar{x}^{(3)}}\right)$$
$$\times\frac{\partial^2}{\partial x_\beta^{(4)}\partial x_\beta^{(4)}}\int g_\alpha^{(4)}F_4^{(1,2,3,4)}dv^{(4)}dg^{(4)}d\phi^{(4)}d\psi^{(4)}$$
$$+\gamma\left(\frac{\partial}{\partial\phi^{(1)}}\lim_{\bar{x}^{(4)}\to\bar{x}^{(1)}}+\frac{\partial}{\partial\phi^{(2)}}\lim_{\bar{x}^{(4)}\to\bar{x}^{(2)}}+\frac{\partial}{\partial\phi^{(3)}}\lim_{\bar{x}^{(4)}\to\bar{x}^{(3)}}\right)$$
$$\times\frac{\partial^2}{\partial x_\beta^{(4)}\partial x_\beta^{(4)}}\int\phi^{(4)}F_4^{(1,2,3,4)}dv^{(4)}dg^{(4)}d\phi^{(4)}d\psi^{(4)}$$
$$+D\left(\frac{\partial}{\partial\psi^{(1)}}\lim_{\bar{x}^{(4)}\to\bar{x}^{(1)}}+\frac{\partial}{\partial\psi^{(2)}}\lim_{\bar{x}^{(4)}\to\bar{x}^{(2)}}+\frac{\partial}{\partial\psi^{(3)}}\lim_{\bar{x}^{(4)}\to\bar{x}^{(3)}}\right)$$
$$\times\frac{\partial^2}{\partial x_\beta^{(4)}\partial x_\beta^{(4)}}\int\psi^{(4)}F_4^{(1,2,3,4)}dv^{(4)}dg^{(4)}d\phi^{(4)}d\psi^{(4)}$$

$$-\left[\frac{\partial}{\partial v_\alpha^{(1)}}\left\{\frac{1}{4\pi}\int\frac{\partial}{\partial x_\alpha^{(1)}}\left(\frac{1}{\left|\bar{x}^{(4)}-\bar{x}^{(1)}\right|}\right)\right\}+\frac{\partial}{\partial v_\alpha^{(2)}}\left\{\frac{1}{4\pi}\int\frac{\partial}{\partial x_\alpha^{(2)}}\left(\frac{1}{\left|\bar{x}^{(4)}-\bar{x}^{(2)}\right|}\right)\right\}\right.$$
$$+\frac{\partial}{\partial v_\alpha^{(3)}}\left\{\frac{1}{4\pi}\int\frac{\partial}{\partial x_\alpha^{(3)}}\left(\frac{1}{\left|\bar{x}^{(4)}-\bar{x}^{(3)}\right|}\right)\right\}\times\left(\frac{\partial v_\alpha^{(4)}}{\partial x_\beta^{(4)}}\frac{\partial v_\beta^{(4)}}{\partial x_\alpha^{(4)}}-\frac{\partial g_\alpha^{(4)}}{\partial x_\beta^{(4)}}\frac{\partial g_\beta^{(4)}}{\partial x_\alpha^{(4)}}\right)F_4^{(1,2,3,4)}$$

$$\left.\times\,dx^{(4)}dv^{(4)}dg^{(4)}d\phi^{(4)}d\psi^{(4)}\right]=0 \qquad \text{.......... .......... .......} \tag{101}$$

Continuing this way, we can derive the equations for evolution of $F_4^{(1,2,3,4)}$, $F_5^{(1,2,3,4,5)}$ and so on. Logically it is possible to have an equation for every $F_n$ (n is an integer) but the system of equations so obtained is not closed. Certain approximations will be required thus obtained.

## RESULTS AND DISCUSSION

If we drop the kinetic viscosity (ν), magnetic diffusivity (λ), thermal diffusivity (γ) and concentration (D) terms from the three-point evolution Eq. (101), we have:

$$\frac{\partial F_3^{(1,2,3)}}{\partial t}+\left( v_\beta^{(1)}\frac{\partial}{\partial x_\beta^{(1)}}+v_\beta^{(2)}\frac{\partial}{\partial x_\beta^{(2)}}v_\beta^{(3)}\frac{\partial}{\partial x_\beta^{(3)}}\right)F_3^{(1,2,3)}+\Big[ g_\beta^{(1)}\left(\frac{\partial g_\alpha^{(1)}}{\partial v_\alpha^{(1)}}+\frac{\partial v_\alpha^{(1)}}{\partial g_\alpha^{(1)}}\right)\frac{\partial}{\partial x_\beta^{(1)}}$$

$$+g_\beta^{(2)}\left(\frac{\partial g_\alpha^{(2)}}{\partial v_\alpha^{(2)}}+\frac{\partial v_\alpha^{(2)}}{\partial g_\alpha^{(2)}}\right)\frac{\partial}{\partial x_\beta^{(2)}}+g_\beta^{(3)}\left(\frac{\partial g_\alpha^{(3)}}{\partial v_\alpha^{(3)}}+\frac{\partial v_\alpha^{(3)}}{\partial g_\alpha^{(3)}}\right)\frac{\partial}{\partial x_\beta^{(3)}}\Big]F_3^{(1,2,3)}$$

$$-\Big[\frac{\partial}{\partial v_\alpha^{(1)}}\left\{\frac{1}{4\pi}\int\frac{\partial}{\partial x_\alpha^{(1)}}\left(\frac{1}{\left|\bar{x}^{(4)}-\bar{x}^{(1)}\right|}\right)\right\}+\frac{\partial}{\partial v_\alpha^{(2)}}\left\{\frac{1}{4\pi}\int\frac{\partial}{\partial x_\alpha^{(2)}}\left(\frac{1}{\left|\bar{x}^{(4)}-\bar{x}^{(2)}\right|}\right)\right\}$$

$$+\frac{\partial}{\partial v_\alpha^{(3)}}\left\{\frac{1}{4\pi}\int\frac{\partial}{\partial x_\alpha^{(3)}}\left(\frac{1}{\left|\bar{x}^{(4)}-\bar{x}^{(3)}\right|}\right)\right\}\times\left(\frac{\partial v_\alpha^{(4)}}{\partial x_\beta^{(4)}}\frac{\partial v_\beta^{(4)}}{\partial x_\alpha^{(4)}}-\frac{\partial g_\alpha^{(4)}}{\partial x_\beta^{(4)}}\frac{\partial g_\beta^{(4)}}{\partial x_\alpha^{(4)}}\right)F_4^{(1,2,3,4)}$$

$$\times dx^{(4)}dv^{(4)}dg^{(4)}d\phi^{(4)}d\psi^{(4)}\Big]=0. \tag{102}$$

The existence of the term:

$$\left(\frac{\partial g_\alpha^{(1)}}{\partial v_\alpha^{(1)}}+\frac{\partial v_\alpha^{(1)}}{\partial g_\alpha^{(1)}}\right),\ \left(\frac{\partial g_\alpha^{(2)}}{\partial v_\alpha^{(2)}}+\frac{\partial v_\alpha^{(2)}}{\partial g_\alpha^{(2)}}\right)\text{ and }\left(\frac{\partial g_\alpha^{(3)}}{\partial v_\alpha^{(3)}}+\frac{\partial v_\alpha^{(3)}}{\partial g_\alpha^{(3)}}\right)$$

can be explained on the basis that two characteristics of the flow field are related to each other and describe the interaction between the two modes (velocity and magnetic) at the point $x^{(1)}$, $x^{(2)}$ and $x^{(3)}$.

We can exhibit an analogy of this equation with the 1st equation in BBGKY hierarchy in the kinetic theory of gases. The first equation of BBGKY hierarchy is given as:

$$\frac{\partial F_1^{(1)}}{\partial t}+\frac{1}{m}v_\beta^{(1)}\frac{\partial}{\partial x_\beta^{(1)}}F_1^{(1)}=n\iint\frac{\partial\psi_{1,2}}{\partial x_\alpha^{(1)}}\frac{\partial F_2^{(1,2)}}{\partial v_\alpha^{(1)}}d\bar{x}^{(2)}d\bar{v}^{(2)} \tag{103}$$

where $\psi_{1,2}=\psi\left|v_\alpha^{(2)}-v_\alpha^{(1)}\right|$ is the inter molecular potential.

In order to close the system of equations for the distribution functions, some approximations are required. If we consider the collection of ionized particles, i.e., in plasma turbulence case, it can be provided closure form easily by decomposing $F_2^{(1,2)}$ as $F_1^{(1)}$ $F_1^{(2)}$. But such type of approximations can be possible if there is no interaction or correlation between two particles. If we decompose $F_2^{(1,2)}$ as:

$F_2^{(1,2)} = (1+\in)\, F_1^{(1)}\, F_1^{(2)}$ and

$F_3^{(1,2,3)} = (1+\in)^2\, F_1^{(1)}\, F_1^{(2)}\, F_1^{(3)}$ Also

$F_4^{(1,2,3,4)} = (1+\in)^3\, F_1^{(1)}\, F_1^{(2)}\, F_1^{(3)}\, F_1^{(4)}$

where $\in$ is the correlation coefficient between the particles. If there is no correlation between the particles, $\in$ will be zero and distribution function can be decomposed in usual way. Here we are considering such type of approximation only to provide closed from of the equation.

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