MODELING OF MANUFACTURING OF A FIELD-EFFECT TRANSISTOR TO DETERMINE CONDITIONS TO DECREASE LENGTH OF CHANNEL

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ABSTRACT

In this paper we introduce an approach to model technological process of manufacture of a field-effect heterotransistor. The modeling gives us possibility to optimize the technological process to decrease length of channel by using mechanical stress. As accompanying results of the decreasing one can find decreasing of thickness of the heterotransistors and increasing of their density, which were comprised in integrated circuits.

KEYWORDS

Modelling of manufacture of a field-effect heterotransistor, Accounting mechanical stress; Optimization the technological process, Decreasing length of channel

1. INTRODUCTION

One of intensively solved problems of the solid-state electronics is decreasing of elements of integrated circuits and their discrete analogs [1-7]. To solve this problem attracted an interest widely used laser and microwave types of annealing [8-14]. These types of annealing leads to generation of inhomogeneous distribution of temperature. In this situation one can obtain increasing of sharpness of *p*-*n*-junctions with increasing of homogeneity of dopant distribution in enriched area [8-14]. The first effects give us possibility to decrease switching time of *p*-*n*-junction and value of local overheats during operating of the device or to manufacture more shallow *p*-*n*-junction with fixed maximal value of local overheat. An alternative approach to laser and microwave types of annealing one can use native inhomogeneity of heterostructure and optimization of annealing of dopant and/or radiation defects to manufacture diffusive –junction and implanted-junction rectifiers [12-18]. It is known, that radiation processing of materials is also leads to modification of distribution of dopant concentration [19]. The radiation processing could be also used to increase of sharpness of *p*-*n*-junctions with increasing of homogeneity of dopant distribution in enriched area [20, 21]. Distribution of dopant concentration is also depends on mechanical stress in heterostructure [15].

In this paper we consider a field-effect heterotransistor. Manufacturing of the transistor based on combination of main ideas of Refs. [5] and [12-18]. Framework the combination we consider a heterostructure with a substrate and an epitaxial layer with several sections. Some dopants have been infused or implanted into the section to produce required types of conductivity. Farther we consider optimal annealing of dopant and/or radiation defects. Manufacturing of the transistor has been considered in details in Ref. [17]. Main aim of the present paper is analysis of influence of mechanical stress on length of channel of the field-effect transistor.

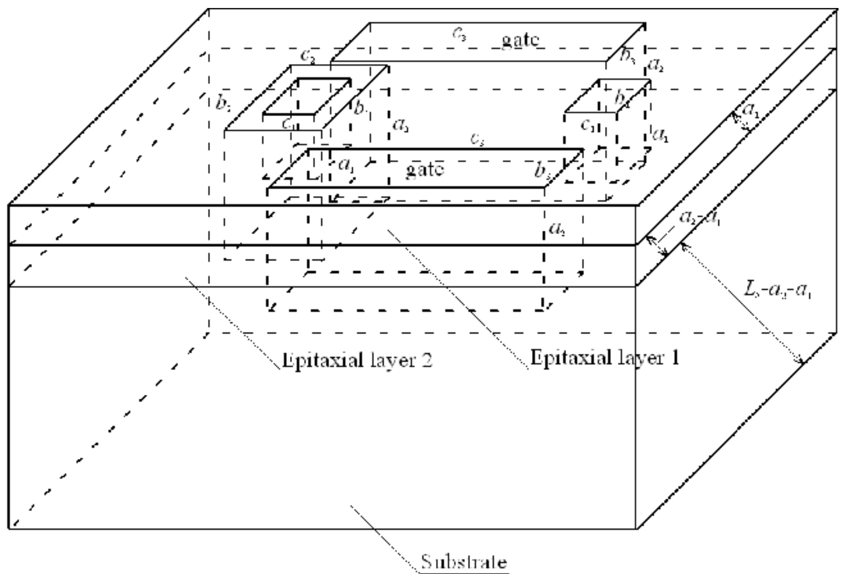

Fig. 1. Heterostructure with substrate and epitaxial layer with two or three sections

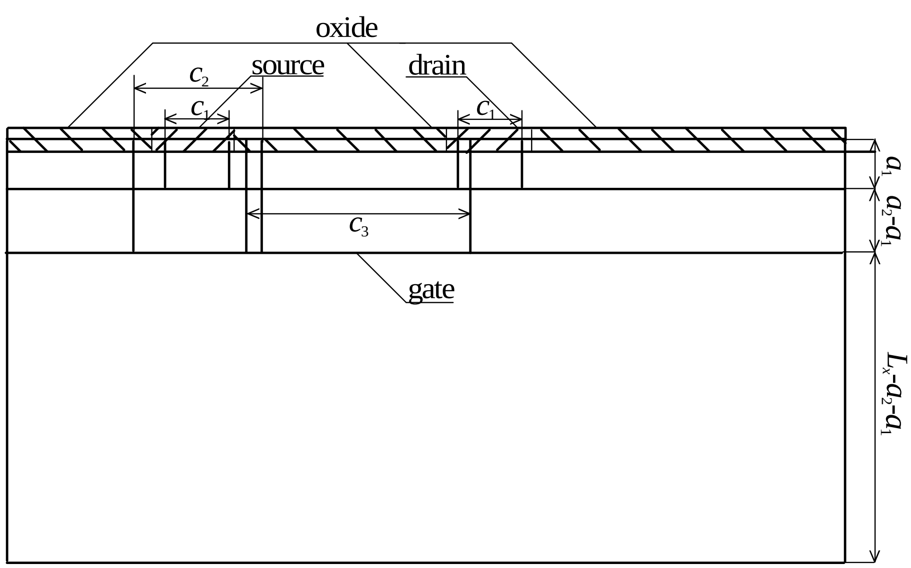

Fig. 2. Heterostructure with substrate and epitaxial layer with two or three sections. Sectional view

2. METHOD OF SOLUTION

To solve our aim we determine spatio-temporal distribution of concentration of dopant in the considered heterostructure and make the analysis. We determine spatio-temporal distribution of concentration of dopant with account mechanical stress by solving the second Fick's law [1-4,22,23]

$$\frac{\partial C(x,y,z,t)}{\partial t}=\frac{\partial}{\partial x}\left[D\frac{\partial C(x,y,z,t)}{\partial x}\right]+\frac{\partial}{\partial y}\left[D\frac{\partial C(x,y,z,t)}{\partial y}\right]+\frac{\partial}{\partial z}\left[D\frac{\partial C(x,y,z,t)}{\partial z}\right]+ \quad (1)$$
$$+\Omega\frac{\partial}{\partial x}\left[\frac{D_S}{kT}\nabla_S\mu\,(x,y,z,t)\int\limits_0^{L_z}C(x,y,W,t)\,dW\right]+\Omega\frac{\partial}{\partial y}\left[\frac{D_S}{kT}\nabla_S\mu\,(x,y,z,t)\int\limits_0^{L_z}C(x,y,W,t)\,dW\right]$$

with boundary and initial conditions

$$\left.\frac{\partial C(x,y,z,t)}{\partial x}\right|_{x=0}=0,\ \left.\frac{\partial C(x,y,z,t)}{\partial x}\right|_{x=L_x}=0,\ \left.\frac{\partial C(x,y,z,t)}{\partial y}\right|_{y=0}=0,\ \left.\frac{\partial C(x,y,z,t)}{\partial y}\right|_{x=L_y}=0,$$
$$\left.\frac{\partial C(x,y,z,t)}{\partial z}\right|_{z=0}=0,\ \left.\frac{\partial C(x,y,z,t)}{\partial z}\right|_{x=L_z}=0,\ C(x,y,z,0)=f_C(x,y,z).$$

Here $C(x,y,z,t)$ is the spatio-temporal distribution of concentration of dopant; Ω is the atomic volume; ∇_S is the operators of surficial gradient; $\int\limits_0^{L_z}C(x,y,z,t)\,dz$ is the surficial concentration of dopant on interface between layers of heterostructure; $\mu(x,y,z,t)$ is the chemical potential; D and D_S are coefficients of volumetric and surficial (due to mechanical stress) of diffusion. Values of the diffusion coefficients depend on properties of materials of heterostructure, speed of heating and cooling of heterostructure, spatio-temporal distribution of concentration of dopant. Concentraional dependence of dopant diffusion coefficients have been approximated by the following relations [24]

$$D=D_L(x,y,z,T)\left[1+\xi\frac{C^{\gamma}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\right],\ D_S=D_{SL}(x,y,z,T)\left[1+\xi_S\frac{C^{\gamma}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\right]. \quad (2)$$

Here $D_L(x,y,z,T)$ and $D_{LS}(x,y,z,T)$ are spatial (due to inhomogeneity of heterostructure) and temperature (due to Arrhenius law) dependences of dopant diffusion coefficients; T is the temperature of annealing; $P(x,y,z,T)$ is the limit of solubility of dopant; parameter γ could be integer in the following interval $\gamma\in[1,3]$ [24]; $V(x,y,z,t)$ is the spatio-temporal distribution of concentration of radiation of vacancies; V^* is the equilibrium distribution of vacancies. Concentrational dependence of dopant diffusion coefficients has been discussed in details in [24]. Chemical potential could be determine by the following relation [22]

$$\mu=E(z)\Omega\sigma_{ij}[u_{ij}(x,y,z,t)+u_{ji}(x,y,z,t)]/2, \quad (3)$$

where E is the Young modulus; σ_{ij} is the stress tensor; $u_{ij}=\frac{1}{2}\left(\frac{\partial u_i}{\partial x_j}+\frac{\partial u_j}{\partial x_i}\right)$ is the deformation tensor; u_i, u_j are the components $u_x(x,y,z,t)$, $u_y(x,y,z,t)$ and $u_z(x,y,z,t)$ of the displacement vector $\vec{u}(x,y,z,t)$; x_i, x_j are the coordinates x, y, z. Relation (3) could be transform to the following form

$$\mu(x,y,z,t)=\left[\frac{\partial u_i(x,y,z,t)}{\partial x_j}+\frac{\partial u_j(x,y,z,t)}{\partial x_i}\right]\left\{\frac{1}{2}\left[\frac{\partial u_i(x,y,z,t)}{\partial x_j}+\frac{\partial u_j(x,y,z,t)}{\partial x_i}\right]\times\right.$$
$$\left.\times E(z)\frac{\Omega}{2}-\varepsilon_0\delta_{ij}+\frac{\sigma(z)\delta_{ij}}{1-2\sigma(z)}\left[\frac{\partial u_k(x,y,z,t)}{\partial x_k}-3\varepsilon_0\right]-K(z)\beta(z)[T(x,y,z,t)-T_0]\,\delta_{ij}\right\},$$

where σ is the Poisson coefficient; $\varepsilon_0=(a_s-a_{EL})/a_{EL}$ is the mismatch strain; a_s, a_{EL} are the lattice spacings for substrate and epitaxial layer, respectively; K is the modulus of uniform compression; β is the coefficient of thermal expansion; T_r is the equilibrium temperature, which coincide (for our case) with room temperature. Components of displacement vector could be obtained by solving of the following equations [23]

$$\begin{cases}\rho(z)\dfrac{\partial^2 u_x(x,y,z,t)}{\partial t^2}=\dfrac{\partial\sigma_{xx}(x,y,z,t)}{\partial x}+\dfrac{\partial\sigma_{xy}(x,y,z,t)}{\partial y}+\dfrac{\partial\sigma_{xz}(x,y,z,t)}{\partial z}\\ \rho(z)\dfrac{\partial^2 u_y(x,y,z,t)}{\partial t^2}=\dfrac{\partial\sigma_{yx}(x,y,z,t)}{\partial x}+\dfrac{\partial\sigma_{yy}(x,y,z,t)}{\partial y}+\dfrac{\partial\sigma_{yz}(x,y,z,t)}{\partial z}\\ \rho(z)\dfrac{\partial^2 u_z(x,y,z,t)}{\partial t^2}=\dfrac{\partial\sigma_{zx}(x,y,z,t)}{\partial x}+\dfrac{\partial\sigma_{zy}(x,y,z,t)}{\partial y}+\dfrac{\partial\sigma_{zz}(x,y,z,t)}{\partial z}\end{cases}$$

where $\sigma_{ij}=\frac{E(z)}{2[1+\sigma(z)]}\left[\frac{\partial u_i(x,y,z,t)}{\partial x_j}+\frac{\partial u_j(x,y,z,t)}{\partial x_i}-\frac{\delta_{ij}}{3}\frac{\partial u_k(x,y,z,t)}{\partial x_k}\right]+\delta_{ij}\frac{\partial u_k(x,y,z,t)}{\partial x_k}\times$ $\times K(z)-\beta(z)K(z)[T(x,y,z,t)-T_r]$, $\rho(z)$ is the density of materials, δ_{ij} is the Kronecker symbol. With account of the relation the last system of equation takes the form

$$\rho(z)\frac{\partial^2 u_x(x,y,z,t)}{\partial t^2}=\left\{K(z)+\frac{5E(z)}{6[1+\sigma(z)]}\right\}\frac{\partial^2 u_x(x,y,z,t)}{\partial x^2}+\left\{K(z)-\frac{E(z)}{3[1+\sigma(z)]}\right\}\frac{\partial^2 u_y(x,y,z,t)}{\partial x\partial y}+$$
$$+\frac{E(z)}{2[1+\sigma(z)]}\left[\frac{\partial^2 u_y(x,y,z,t)}{\partial y^2}+\frac{\partial^2 u_z(x,y,z,t)}{\partial z^2}\right]+\left[K(z)+\frac{E(z)}{3[1+\sigma(z)]}\right]\frac{\partial^2 u_z(x,y,z,t)}{\partial x\partial z}-K(z)\times$$
$$\times\beta(z)\frac{\partial T(x,y,z,t)}{\partial x}$$
$$\rho(z)\frac{\partial^2 u_y(x,y,z,t)}{\partial t^2}=\frac{E(z)}{2[1+\sigma(z)]}\left[\frac{\partial^2 u_y(x,y,z,t)}{\partial x^2}+\frac{\partial^2 u_x(x,y,z,t)}{\partial x\partial y}\right]-\beta(z)K(z)\frac{\partial T(x,y,z,t)}{\partial y}+$$
$$+\frac{\partial}{\partial z}\left\{\frac{E(z)}{2[1+\sigma(z)]}\left[\frac{\partial u_y(x,y,z,t)}{\partial z}+\frac{\partial u_z(x,y,z,t)}{\partial y}\right]\right\}+\left\{\frac{5E(z)}{12[1+\sigma(z)]}+K(z)\right\}\frac{\partial^2 u_y(x,y,z,t)}{\partial y^2}+$$
$$+\left\{K(z)-\frac{E(z)}{6[1+\sigma(z)]}\right\}\frac{\partial^2 u_y(x,y,z,t)}{\partial y\partial z}+K(z)\frac{\partial^2 u_y(x,y,z,t)}{\partial x\partial y}\qquad(4)$$

$$\rho(z)\frac{\partial^2 u_z(x,y,z,t)}{\partial t^2}=\left[\frac{\partial^2 u_z(x,y,z,t)}{\partial x^2}+\frac{\partial^2 u_z(x,y,z,t)}{\partial y^2}+\frac{\partial^2 u_x(x,y,z,t)}{\partial x\partial z}+\frac{\partial^2 u_y(x,y,z,t)}{\partial y\partial z}\right]\times$$

$$\times\frac{E(z)}{2[1+\sigma(z)]}+\frac{\partial}{\partial z}\left\{K(z)\left[\frac{\partial u_x(x,y,z,t)}{\partial x}+\frac{\partial u_y(x,y,z,t)}{\partial y}+\frac{\partial u_x(x,y,z,t)}{\partial z}\right]\right\}-\frac{\partial T(x,y,z,t)}{\partial z}\times$$

$$\times K(z)\beta(z)+\frac{1}{6}\frac{\partial}{\partial z}\left\{\frac{E(z)}{1+\sigma(z)}\left[6\frac{\partial u_z(x,y,z,t)}{\partial z}-\frac{\partial u_x(x,y,z,t)}{\partial x}-\frac{\partial u_y(x,y,z,t)}{\partial y}-\frac{\partial u_z(x,y,z,t)}{\partial z}\right]\right\}.$$

Conditions for the displacement vector could be written as

$$\frac{\partial \vec{u}(0,y,z,t)}{\partial x}=0;\ \frac{\partial \vec{u}(L_x,y,z,t)}{\partial x}=0;\ \frac{\partial \vec{u}(x,0,z,t)}{\partial y}=0;\ \frac{\partial \vec{u}(x,L_y,z,t)}{\partial y}=0;$$

$$\frac{\partial \vec{u}(x,y,0,t)}{\partial z}=0;\ \frac{\partial \vec{u}(x,y,L_z,t)}{\partial z}=0;\ \vec{u}(x,y,z,0)=\vec{u}_0;\ \vec{u}(x,y,z,\infty)=\vec{u}_0.$$

Farther let us analyze spatio-temporal distribution of temperature during annealing of dopant. We determine spatio-temporal distribution of temperature as solution of the second law of Fourier [25]

$$c(T)\frac{\partial T(x,y,z,t)}{\partial t}=\frac{\partial}{\partial x}\left[\lambda\frac{\partial T(x,y,z,t)}{\partial x}\right]+\frac{\partial}{\partial y}\left[\lambda\frac{\partial T(x,y,z,t)}{\partial y}\right]+\frac{\partial}{\partial z}\left[\lambda\frac{\partial T(x,y,z,t)}{\partial z}\right]+ + p(x,y,z,t) \quad (5)$$

with boundary and initial conditions

$$\left.\frac{\partial T(x,y,z,t)}{\partial x}\right|_{x=0}=0,\ \left.\frac{\partial T(x,y,z,t)}{\partial x}\right|_{x=L_x}=0,\ \left.\frac{\partial T(x,y,z,t)}{\partial y}\right|_{y=0}=0,\ \left.\frac{\partial T(x,y,z,t)}{\partial y}\right|_{x=L_y}=0,$$

$$\left.\frac{\partial T(x,y,z,t)}{\partial z}\right|_{z=0}=0,\ \left.\frac{\partial T(x,y,z,t)}{\partial z}\right|_{x=L_z}=0,\ T(x,y,z,0)=f_T(x,y,z).$$

Here λ is the heat conduction coefficient. Value of the coefficient depends on materials of hetero-structure and temperature. Temperature dependence of heat conduction coefficient in most interest area could be approximated by the following function: $\lambda(x,y,z,T)=\lambda_{ass}(x,y,z)[1+\mu\ T_d^{\varphi}/T^{\varphi}(x,y,z,t)]$ (see, for example, [25]). $c(T)=c_{ass}[1-\vartheta\, exp(-T(x,y,z,t)/T_d)]$ is the heat capacitance; T_d is the Debye temperature [25]. The temperature $T(x,y,z,t)$ is approximately equal or larger, than Debye temperature T_d for most interesting for us temperature interval. In this situation one can write the following approximate relation: $c(T)\approx c_{ass}$. $p(x,y,z,t)$ is the volumetric density of heat, which escapes in the heterostructure. Framework the paper it is attracted an interest microwave annealing of dopant. This approach leads to generation inhomogenous distribution of temperature [12-14,26]. Such distribution of temperature gives us possibility to increase sharpness of *p*-*n*-junctions with increasing of homogeneity of dopant distribution in enriched area. In this situation it is practicably to choose frequency of electro-magnetic field. After this choosing thickness of scin-layer should be approximately equal to thickness of epitaxial layer.

First of all we calculate spatio-temporal distribution of temperature. We calculate spatio-temporal distribution of temperature by using recently introduce approach [15, 17,18]. Framework the approach we transform approximation of thermal diffusivity $\alpha_{ass}(x,y,z)=\lambda_{ass}(x,y,z)/c_{ass}=\alpha_{0ass}[1+\varepsilon_T\, g_T(x,y,z)]$. Farther we determine solution of Eqs. (5) as the following power series

$$T(x,y,z,t)=\sum_{i=0}^{\infty}\varepsilon_T^i\sum_{j=0}^{\infty}\mu^j T_{ij}(x,y,z,t). \quad (6)$$

Substitution of the series into Eq.(6) gives us possibility to obtain system of equations for the initial-order approximation of temperature $T_{00}(x,y,z,t)$ and corrections for them $T_{ij}(x,y,z,t)$ ($i\geq1$, $j\geq1$). The equations are presented in the Appendix. Substitution of the series (6) in boundary and initial conditions for spatio-temporal distribution of temperature gives us possibility to obtain boundary and initial conditions for the functions $T_{ij}(x,y,z,t)$ ($i\geq0$, $j\geq0$). The conditions are presented in the Appendix. Solutions of the equations for the functions $T_{ij}(x,y,z,t)$ ($i\geq0$, $j\geq0$) have been obtain as the second-order approximation on the parameters ε and μ by standard approaches [28,29] and presented in the Appendix. Recently we obtain, that the second-order approximation is enough good approximation to make qualitative analysis and to obtain some quantitative results (see, for example, [15,17,18]). Analytical results have allowed to identify and to illustrate the main dependence. To check our results obtained we used numerical approaches.

Farther let us estimate components of the displacement vector. The components could be obtained by using the same approach as for calculation distribution of temperature. However, relations for components could by calculated in shorter form by using method of averaging of function corrections [12-14,16,27]. It is practicably to transform differential equations of system (4) to integro-differential form. The integral equations are presented in the Appendix. We determine the first-order approximations of components of the displacement vector by replacement the required functions $u_\beta(x,y,z,t)$ on their average values $\alpha_{u\beta1}$. The average values $\alpha_{u\beta1}$ have been calculated by the following relations

$$\alpha_{us1}=M_{s1}/4L\Theta, \tag{7}$$

where $M_{si}=\int\limits_0^\Theta\int\limits_{-L_x}^{L_x}\int\limits_{-L_y}^{L_y}\int\limits_0^{L_z}u_{si}(x,y,z,t)\,d\,z\,d\,y\,d\,x\,d\,t$. The replacement leads to the following results

$$u_{x1}(x,y,z,t)=\left[t\int\limits_0^\infty\int\limits_0^z K(w)\alpha(w)\frac{\partial T(x,y,w,\tau)}{\partial x}d\,w\,d\,\tau-\int\limits_0^t(t-\tau)\int\limits_0^z K(w)\beta(w)\frac{\partial T(x,y,w,\tau)}{\partial x}d\,w\,d\,\tau-\right.$$
$$\left.-\alpha_{ux1}\Phi_{x0}(x,y,w,t)\right]\phi+\alpha_{ux1},$$

$$u_{y1}(x,y,z,t)=\left[t\int\limits_0^\infty\int\limits_0^z K(w)\alpha(w)\frac{\partial T(x,y,w,\tau)}{\partial y}d\,w\,d\,\tau-\int\limits_0^t(t-\tau)\int\limits_0^z K(w)\beta(w)\frac{\partial T(x,y,w,\tau)}{\partial y}d\,w\,d\,\tau-\right.$$
$$\left.-\alpha_{uy1}\Phi_{y0}(x,y,w,t)\right]\phi+\alpha_{uy1},$$

$$u_{z1}(x,y,z,t)=\left[t\int\limits_0^\infty\int\limits_0^z K(w)\alpha(w)\frac{\partial T(x,y,w,\tau)}{\partial w}d\,w\,d\,\tau\int\limits_0^t(t-\tau)\int\limits_0^z K(w)\beta(w)\frac{\partial T(x,y,w,\tau)}{\partial w}d\,w\,d\,\tau-\right.$$
$$\left.-\alpha_{uz1}\Phi_{z0}(x,y,w,t)\right]\phi+\alpha_{z1}.$$

Substitution of the above relations into relations (7) gives us possibility to obtain values of the parameters $\alpha_{u\beta1}$. Appropriate relations could be written as

$$\alpha_{ux1}=\Theta\frac{L_z\left[\mathrm{X}_{x0}(\infty)-\mathrm{X}_{x2}(\Theta)\right]}{8L^3\int\limits_0^{L_z}(L_z-z)\rho(z)d\,z},\ \alpha_{uy1}=\Theta\frac{L_z\left[\mathrm{X}_{y0}(\infty)-\mathrm{X}_{y2}(\Theta)\right]}{8L^3\int\limits_0^{L_z}(L_z-z)\rho(z)d\,z},\ \alpha_{uz1}=\frac{\Theta L_z\left[\mathrm{X}_{z0}(\infty)-\mathrm{X}_{z2}(\Theta)\right]}{8L^3\int\limits_0^{L_z}(L_z-z)\rho(z)d\,z},$$

where $\mathrm{X}_{si}(\Theta)=\int\limits_0^\Theta\left(1+\frac{t}{\Theta}\right)^i\int\limits_{-L_x}^{L_x}\int\limits_{-L_y}^{L_y}\int\limits_0^{L_z}(L_z-z)K(z)\chi(z)\frac{\partial T(x,y,z,\tau)}{\partial s}d\,z\,d\,y\,d\,x\,d\,\tau$.

The second-order approximations of components of the displacement vector by replacement of the required functions $u_\beta(x,y,z,t)$ on the following sums $\alpha_{us2}+u_{s1}(x,y,z,t)$, where $\alpha_{us2}=(M_{us2}-M_{us1})/4L^3\Theta$. Results of calculations of the second-order approximations $u_{s2}(x,y,z,t)$ and their average values α_{us2} are presented in the Appendix, because the relations are bulky.

Spatio-temporal distribution of concentration of dopant we obtain by solving the Eq.(1). To solve the equations we used recently introduce approach [15,17,18] and transform approximations of dopant diffusion coefficients D_L (x,y,z,T) and D_{SL} (x,y,z, T) to the following form: $D_L(x,y,z,T)=D_{0L}[1+\varepsilon_L\, g_L(x,y,z,T)]$ and $D_{SL}(x,y,z,T)=D_{0SL}[1+ \varepsilon_{SL}g_{SL}(x,y,z,T)]$. We also introduce the following dimensionless parameter: $\omega = D_{0SL}/ D_{0L}$. In this situation the Eq.(1) takes the form

$$\frac{\partial C(x,y,z,t)}{\partial t}=D_{0L}\frac{\partial}{\partial x}\left\{[1+\varepsilon_L g_L(z,T)]\left[1+\xi\frac{C^\gamma(x,y,z,t)}{P^\gamma(z,T)}\right]\frac{\partial C(x,y,z,t)}{\partial x}\right\}+\frac{\partial}{\partial y}\left\{\frac{\partial C(x,y,z,t)}{\partial y}\times\right.$$
$$\left.\times[1+\varepsilon_L g_L(z,T)]\left[1+\xi\frac{C^\gamma(x,y,z,t)}{P^\gamma(x,y,z,T)}\right]\right\}D_{0L}+D_{0L}\frac{\partial}{\partial z}\left\{[1+\varepsilon_L g_L(x,y,z,T)]\left[1+\xi\frac{C^\gamma(x,y,z,t)}{P^\gamma(x,y,z,T)}\right]\times\right.$$
$$\left.\times\frac{\partial C(x,y,z,t)}{\partial z}\right\}+\omega\Omega D_{0L}\frac{\partial}{\partial x}\left\{[1+\varepsilon_{SL}g_{SL}(z,T)]\left[1+\xi_S\frac{C^\gamma(x,y,z,t)}{P^\gamma(z,T)}\right]\int_0^{L_z}C(x,y,W,t)\,dW\times\right. \quad (8)$$
$$\left.\times\frac{\nabla_S\mu(x,y,z,t)}{kT}\right\}D_{0L}+\omega\Omega D_{0L}\frac{\partial}{\partial y}\left\{\left[1+\xi_S\frac{C^\gamma(x,y,z,t)}{P^\gamma(z,T)}\right]\frac{\nabla_S\mu(x,y,z,t)}{kT}\int_0^{L_z}C(x,y,W,t)\,dW\right\}.$$

We determine solution of Eq.(1) as the following power series

$$C(x,y,z,t)=\sum_{i=0}^{\infty}\varepsilon_L^i\sum_{j=0}^{\infty}\xi^j\sum_{k=0}^{\infty}\omega^k C_{ijk}(x,y,z,t). \quad (9)$$

Substitution of the series into Eq.(8) gives us possibility to obtain systems of equations for initial-order approximation of concentration of dopant $C_{000}(x,y,z,t)$ and corrections for them $C_{ijk}(x, y,z,t)$ ($i\geq1$, $j\geq1$, $k\geq1$).The equations are presented in the Appendix. Substitution of the series into appropriate boundary and initial conditions gives us possibility to obtain boundary and initial conditions for all functions $C_{ijk}(x,y,z,t)$ ($i\geq0$, $j\geq0$, $k\geq0$). Solutions of equations for the functions $C_{ijk}(x,y,z,t)$ ($i\geq0$, $j\geq0$, $k\geq0$) have been calculated by standard approaches [28,29] and presented in the Appendix.

Analysis of spatio-temporal distributions of concentrations of dopant and radiation defects has been done analytically by using the second-order approximations framework recently introduced power series. The approximation is enough good approximation to make qualitative analysis and to obtain some quantitative results. All obtained analytical results have been checked by comparison with results, calculated by numerical simulation.

3. DISCUSSION

In this section we analyzed redistribution of dopant under influence of mechanical stress based on relations calculated in previous section. Fig. 3 show spatio-temporal distribution of concentration of dopant in a homogenous sample (curve 1) and in heterostructure with negative and positive value of the mismatch strain ε_0 (curve 2 and 3, respectively). The figure shows, that manufacturing field-effect heterotransistors gives us possibility to make more compact field-effect transistors in direction, which is parallel to interface between layers of heterostructure. As a consequence of the increasing of compactness one can obtain decreasing of length of channel of field- effect transistor and increasing of density of the transistors in integrated circuits. It should be noted, that presents of interface between layers of heterostructure give us possibility to manufacture more thin transistors [17].

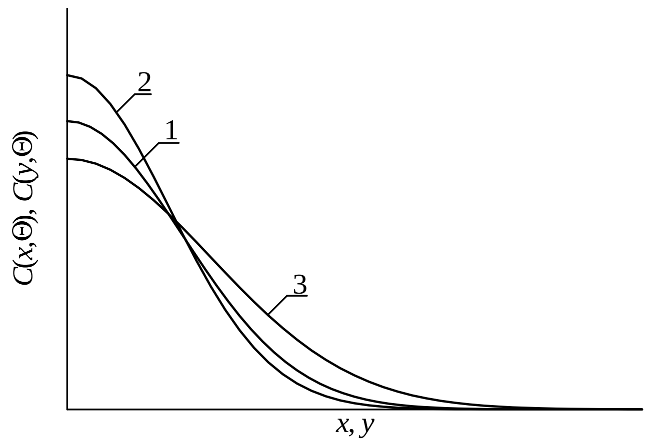

Fig. 3. Distributions of concentration of dopant in directions, which is perpendicular to interface between layers of heterostructure. Curve 1 is a dopant distribution in a homogenous sample. Curve 2 corresponds to negative value of the mismatch strain. Curve 3 corresponds to positive value of the mismatch strain

4. CONCLUSION

In this paper we consider possibility to decrease length of channel of field-effect transistor by using mechanical stress in heterostructure. At the same time with decreasing of the length it could be increased density of transistors in integrated circuits.

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APPENDIX

Equations for functions $T_{ij}(x,y,z,t)$ ($i\geq0$, $j\geq0$)

$$\frac{\partial T_{00}(x,y,z,t)}{\partial t}=\alpha_{0ass}\left[\frac{\partial^2 T_{00}(x,y,z,t)}{\partial x^2}+\frac{\partial^2 T_{00}(x,y,z,t)}{\partial y^2}+\frac{\partial^2 T_{00}(x,y,z,t)}{\partial z^2}\right]+\frac{p(x,y,z,t)}{\nu_{ass}}$$

$$\frac{\partial T_{i0}(x,y,z,t)}{\partial t}=\alpha_{0ass}\left[\frac{\partial^2 T_{i0}(x,y,z,t)}{\partial x^2}+\frac{\partial^2 T_{i0}(x,y,z,t)}{\partial y^2}+\frac{\partial^2 T_{i0}(x,y,z,t)}{\partial z^2}\right]+$$
$$+\alpha_{0ass}\left\{g_T(z)\frac{\partial^2 T_{i-10}(x,y,z,t)}{\partial x^2}+g_T(x)\frac{\partial^2 T_{i-10}(x,y,z,t)}{\partial y^2}+\frac{\partial}{\partial z}\left[g_T(z)\frac{\partial T_{i-10}(x,y,z,t)}{\partial z}\right]\right\},\ i\geq1$$

$$\frac{\partial T_{01}(x,y,z,t)}{\partial t}=\alpha_{0ass}\left[\frac{\partial^2 T_{01}(x,y,z,t)}{\partial x^2}+\frac{\partial^2 T_{01}(x,y,z,t)}{\partial y^2}+\frac{\partial^2 T_{01}(x,y,z,t)}{\partial z^2}\right]+\frac{\alpha_{0ass}T_d^{\varphi}}{T_{00}^{\varphi}(x,y,z,t)}\times$$
$$\times\left[\frac{\partial^2 T_{00}(x,y,z,t)}{\partial x^2}+\frac{\partial^2 T_{00}(x,y,z,t)}{\partial y^2}+\frac{\partial^2 T_{00}(x,y,z,t)}{\partial z^2}\right]-\frac{\alpha_{0ass}T_d^{\varphi}}{T_{00}^{\varphi}(x,y,z,t)}\left\{\left[\frac{\partial T_{00}(x,y,z,t)}{\partial x}\right]^2+\right.$$
$$\left.+\left[\frac{\partial T_{00}(x,y,z,t)}{\partial y}\right]^2+\left[\frac{\partial T_{00}(x,y,z,t)}{\partial z}\right]^2\right\}$$

$$\frac{\partial T_{02}(x,y,z,t)}{\partial t}=\alpha_{0ass}\left[\frac{\partial^2 T_{02}(x,y,z,t)}{\partial x^2}+\frac{\partial^2 T_{02}(x,y,z,t)}{\partial y^2}+\frac{\partial^2 T_{02}(x,y,z,t)}{\partial z^2}\right]+\frac{\alpha_{0ass}T_d^{\varphi}}{T_{00}^{\varphi}(x,y,z,t)}\times$$
$$\times\left[\frac{\partial^2 T_{01}(x,y,z,t)}{\partial x^2}+\frac{\partial^2 T_{01}(x,y,z,t)}{\partial y^2}+\frac{\partial^2 T_{01}(x,y,z,t)}{\partial z^2}\right]-\frac{\varphi\,\alpha_{0ass}T_d^{\varphi}}{T_{00}^{\varphi+1}(x,y,z,t)}\left[\frac{\partial T_{00}(x,y,z,t)}{\partial x}\times\right.$$
$$\left.\times\frac{\partial T_{01}(x,y,z,t)}{\partial x}+\frac{\partial T_{00}(x,y,z,t)}{\partial y}\frac{\partial T_{01}(x,y,z,t)}{\partial y}+\frac{\partial T_{00}(x,y,z,t)}{\partial z}\frac{\partial T_{01}(x,y,z,t)}{\partial z}\right]$$

$$\frac{\partial T_{11}(x,y,z,t)}{\partial t}=\alpha_{0ass}\frac{\partial^2 T_{11}(x,y,z,t)}{\partial x^2}+\frac{T_{01}(x,y,z,t)}{T_{00}(x,y,z,t)}\left\{g_T(x,y,z,T)\frac{\partial^2 T_{00}(x,y,z,t)}{\partial x^2}+g_T(x,y,z,T)\times\right.$$
$$\left.\times\frac{\partial^2 T_{00}(x,y,z,t)}{\partial y^2}+\frac{\partial}{\partial z}\left[g_T(x,y,z,T)\frac{\partial T_{00}(x,y,z,t)}{\partial z}\right]\right\}\alpha_{0ass}+\left\{\frac{\partial}{\partial x}\left[g_T(x,y,z,T)\frac{\partial T_{01}(x,y,z,t)}{\partial x}\right]+\right.$$
$$\left.+\frac{\partial^2 T_{01}(x,y,z,t)}{\partial x^2}+[1+g_T(x,y,z,T)]\frac{\partial^2 T_{01}(x,y,z,t)}{\partial y^2}+[1+g_T(x,y,z,T)]\frac{\partial^2 T_{01}(x,y,z,t)}{\partial z^2}\right\}\alpha_{0ass}+$$
$$+\left[\frac{T_{10}(x,y,z,t)}{T_{00}^{\varphi+1}(x,y,z,t)}\frac{\partial^2 T_{00}(x,y,z,t)}{\partial x^2}+\frac{T_{10}(x,y,z,t)}{T_{00}^{\varphi+1}(x,y,z,t)}\frac{\partial^2 T_{00}(x,y,z,t)}{\partial y^2}+\frac{T_{10}(x,y,z,t)}{T_{00}^{\varphi+1}(x,y,z,t)}\frac{\partial^2 T_{00}(x,y,z,t)}{\partial z^2}\right]\times$$
$$\times\alpha_{0ass}T_d^{\varphi}+\frac{\alpha_{0ass}T_d^{\varphi}}{T_{00}^{\varphi}(x,y,z,t)}\left[\frac{\partial^2 T_{10}(x,y,z,t)}{\partial x^2}+\frac{\partial^2 T_{10}(x,y,z,t)}{\partial y^2}+\frac{\partial^2 T_{10}(x,y,z,t)}{\partial z^2}\right]+\frac{\alpha_{0ass}T_d^{\varphi}}{T_{00}^{\varphi}(x,y,z,t)}\times$$
$$\times\left\{g_T(x,y,z,T)\frac{\partial^2 T_{10}(x,y,z,t)}{\partial x^2}+g_T(x,y,z,T)\frac{\partial^2 T_{10}(x,y,z,t)}{\partial y^2}+\frac{\partial}{\partial z}\left[g_T(x,y,z,T)\frac{\partial T_{00}(x,y,z,t)}{\partial z}\right]\right\}-$$
$$-\left[\frac{\partial T_{10}(x,y,z,t)}{\partial x}\frac{\partial T_{00}(x,y,z,t)}{\partial x}+\frac{\partial T_{10}(x,y,z,t)}{\partial y}\frac{\partial T_{00}(x,y,z,t)}{\partial y}+\frac{\partial T_{10}(x,y,z,t)}{\partial z}\frac{\partial T_{00}(x,y,z,t)}{\partial z}\right]\times$$
$$\times\frac{\varphi\,\alpha_{0ass}T_d^{\varphi}}{T_{00}^{\varphi+1}(x,y,z,t)}-\frac{g_T(x,y,z,T)}{T_{00}^{\varphi+1}(x,y,z,t)}\left\{\left[\frac{\partial T_{00}(x,y,z,t)}{\partial x}\right]^2+\left[\frac{\partial T_{00}(x,y,z,t)}{\partial y}\right]^2+\left[\frac{\partial T_{00}(x,y,z,t)}{\partial z}\right]^2\right\}\times$$
$$\times\alpha_{0ass}\varphi T_d^{\varphi}.$$

Conditions for the functions $T_{ij}(x,y,z,t)$ ($i\ge0$, $j\ge0$)

$$\left.\frac{\partial T_{ij}(x,y,z,t)}{\partial x}\right|_{x=0}=0,\ \left.\frac{\partial T_{ij}(x,y,z,t)}{\partial x}\right|_{x=L_x}=0,\ \left.\frac{\partial T_{ij}(x,y,z,t)}{\partial y}\right|_{y=0}=0,\ \left.\frac{\partial T_{ij}(x,y,z,t)}{\partial y}\right|_{x=L_y}=0,$$
$$\left.\frac{\partial T_{ij}(x,y,z,t)}{\partial z}\right|_{z=0}=0,\ \left.\frac{\partial T_{ij}(x,y,z,t)}{\partial z}\right|_{x=L_z}=0,\ T_{00}(x,y,z,0)=f_T(x,y,z),\ T_{ij}(x,y,z,0)=0,\ i\ge1,\ j\ge1.$$

Solutions of the equations for the functions $T_{ij}(x,y,z,t)$ ($i\ge0$, $j\ge0$) with account appropriate boundary and initial conditions could be written as

$$T_{00}(x,y,z,t)=\frac{1}{L_x L_y L_z}\int_0^{L_x}\int_0^{L_y}\int_0^{L_z} f_T(u,v,w)\,d\,w\,d\,v\,d\,u+\frac{2}{L_x L_y L_z}\sum_{n=1}^{\infty}c_n(x)c_n(y)c_n(z)e_{nT}(t)\int_0^{L_x}c_n(u)\times$$
$$\times\int_0^{L_y}c_n(v)\int_0^{L_z}c_n(w)f_T(u,v,w)\,d\,w\,d\,v\,d\,u+\frac{1}{L_x L_y L_z}\int_0^t\int_0^{L_x}\int_0^{L_y}\int_0^{L_z}\frac{p(u,v,w,\tau)}{\nu_{ass}}\,d\,w\,d\,v\,d\,u\,d\,\tau+\frac{2}{L_x L_y L_z}\times$$
$$\times\sum_{n=1}^{\infty}c_n(x)c_n(y)c_n(z)e_{nT}(t)\int_0^t e_{nT}(-\tau)\int_0^{L_x}c_n(u)\int_0^{L_y}c_n(v)\int_0^{L_z}c_n(w)\frac{p(u,v,w,\tau)}{\nu_{ass}}\,d\,w\,d\,v\,d\,u\,d\,\tau,$$

where $c_n(\chi)=cos(\pi n\chi/L)$, $e_{nT}(t)=\exp\left[-\pi^2 n^2\alpha_{0ass}t\left(\frac{1}{L_x^2}+\frac{1}{L_y^2}+\frac{1}{L_z^2}\right)\right]$;

$$T_{i0}(x,y,z,t)=2\frac{\pi\,\alpha_{0ass}}{L_x^2 L_y L_z}\sum_{n=1}^{\infty}n\,c_n(x)c_n(y)c_n(z)e_{nT}(t)\int_0^t e_{nT}(-\tau)\int_0^{L_x}s_n(u)\int_0^{L_y}c_n(v)\int_0^{L_z}c_n(w)\;g_T(u,v,w,T)\times$$
$$\times\frac{\partial T_{i-10}(u,v,w,\tau)}{\partial u}\,d\,w\,d\,v\,d\,u\,d\,\tau+2\frac{\pi\,\alpha_{0ass}}{L_x L_y^2 L_z}\sum_{n=1}^{\infty}n\,c_n(x)c_n(y)c_n(z)e_{nT}(t)\int_0^t e_{nT}(-\tau)\int_0^{L_x}c_n(u)\int_0^{L_y}s_n(v)\times$$
$$\times\int_0^{L_z}g_T(u,v,w,T)c_n(w)\frac{\partial T_{i-10}(u,v,w,\tau)}{\partial v}\,d\,w\,d\,v\,d\,u\,d\,\tau+2\frac{\pi\,\alpha_{0ass}}{L_x L_y L_z^2}\sum_{n=1}^{\infty}n\,c_n(x)c_n(y)c_n(z)\,e_{nT}(t)\times$$
$$\times\int_0^t e_{nT}(-\tau)\int_0^{L_x}c_n(u)\int_0^{L_y}c_n(v)\int_0^{L_z}s_n(w)g_T(u,v,w,T)\frac{\partial T_{i-10}(u,v,w,\tau)}{\partial w}\,d\,w\,d\,v\,d\,u\,d\,\tau,\; i\ge 1,$$

where $s_n(\chi)=sin(\pi n\chi/L)$;

$$T_{01}(x,y,z,t)=\alpha_{0ass}\frac{2\pi\,T_d^{\varphi}}{L_x^2 L_y L_z}\sum_{n=1}^{\infty}n\,c_n(x)c_n(y)c_n(z)e_{nT}(t)\int_0^t e_{nT}(-\tau)\int_0^{L_x}s_n(u)\int_0^{L_y}c_n(v)\int_0^{L_z}\frac{\partial^2 T_{00}(u,v,w,\tau)}{\partial u^2}\times$$
$$\times c_n(w)\frac{d\,w\,d\,v\,d\,u\,d\,\tau}{T_{00}^{\varphi}(u,v,w,\tau)}+\alpha_{0ass}\frac{2\pi\,T_d^{\varphi}}{L_x L_y^2 L_z}\sum_{n=1}^{\infty}n\,c_n(x)c_n(y)c_n(z)\,e_{nT}(t)\int_0^t e_{nT}(-\tau)\int_0^{L_x}c_n(u)\int_0^{L_y}s_n(v)\int_0^{L_z}c_n(w)\times$$
$$\times\frac{\partial^2 T_{00}(u,v,w,\tau)}{\partial v^2}\frac{d\,w\,d\,v\,d\,u\,d\,\tau}{T_{00}^{\varphi}(u,v,w,\tau)}+\alpha_{0ass}\frac{2\pi\,T_d^{\varphi}}{L_x L_y L_z^2}\sum_{n=1}^{\infty}n\,c_n(x)c_n(y)c_n(z)e_{nT}(t)\int_0^t e_{nT}(-\tau)\int_0^{L_x}c_n(u)\int_0^{L_y}c_n(v)\times$$
$$\times\int_0^{L_z}s_n(w)\frac{\partial^2 T_{00}(u,v,w,\tau)}{\partial u^2}\frac{d\,w\,d\,v\,d\,u\,d\,\tau}{T_{00}^{\varphi}(u,v,w,\tau)}-2T_d^{\varphi}\frac{\varphi\,\alpha_{0ass}}{L_x L_y L_z}\sum_{n=1}^{\infty}c_n(x)c_n(y)c_n(z)e_{nT}(t)\int_0^t e_{nT}(-\tau)\int_0^{L_x}c_n(u)\times$$
$$\times\int_0^{L_y}c_n(v)\int_0^{L_z}c_n(w)\left[\frac{\partial T_{00}(u,v,w,\tau)}{\partial u}\right]^2\frac{d\,w\,d\,v\,d\,u\,d\,\tau}{T_{00}^{\varphi+1}(u,v,w,\tau)}-2\varphi\frac{\alpha_{0ass}T_d^{\varphi}}{L_x L_y L_z}\sum_{n=1}^{\infty}c_n(x)c_n(y)c_n(z)e_{nT}(t)\int_0^t e_{nT}(-\tau)\times$$
$$\times\int_0^{L_x}c_n(u)\int_0^{L_y}c_n(v)\int_0^{L_z}c_n(w)\left[\frac{\partial T_{00}(u,v,w,\tau)}{\partial v}\right]^2\frac{d\,w\,d\,v\,d\,u\,d\,\tau}{T_{00}^{\varphi+1}(u,v,w,\tau)}-2T_d^{\varphi}\frac{\varphi\,\alpha_{0ass}}{L_x L_y L_z}\sum_{n=1}^{\infty}c_n(x)c_n(y)c_n(z)e_{nT}(t)\times$$
$$\times\int_0^t e_{nT}(-\tau)\int_0^{L_x}c_n(u)\int_0^{L_y}c_n(v)\int_0^{L_z}c_n(w)\left[\frac{\partial T_{00}(u,v,w,\tau)}{\partial w}\right]^2\frac{d\,w\,d\,v\,d\,u\,d\,\tau}{T_{00}^{\varphi+1}(u,v,w,\tau)};$$

$$T_{02}(x,y,z,t)=\alpha_{0ass}\frac{2\pi\,T_d^{\varphi}}{L_x^2 L_y L_z}\sum_{n=1}^{\infty}n\,c_n(x)c_n(y)c_n(z)e_{nT}(t)\int_0^t e_{nT}(-\tau)\int_0^{L_x}s_n(u)\int_0^{L_y}c_n(v)\int_0^{L_z}\frac{\partial^2 T_{01}(u,v,w,\tau)}{\partial u^2}\times$$
$$\times c_n(w)\frac{d\,w\,d\,v\,d\,u\,d\,\tau}{T_{00}^{\varphi}(u,v,w,\tau)}+\alpha_{0ass}\frac{2\pi\,T_d^{\varphi}}{L_x L_y^2 L_z}\sum_{n=1}^{\infty}n\;c_n(x)c_n(y)c_n(z)e_{nT}(t)\int_0^t e_{nT}(-\tau)\int_0^{L_x}c_n(u)\int_0^{L_y}s_n(v)\int_0^{L_z}c_n(w)\times$$
$$\times\frac{\partial^2 T_{01}(u,v,w,\tau)}{\partial v^2}\frac{d\,w\,d\,v\,d\,u\,d\,\tau}{T_{00}^{\varphi}(u,v,w,\tau)}+\alpha_{0ass}\frac{2\pi\,T_d^{\varphi}}{L_x L_y L_z^2}\sum_{n=1}^{\infty}n\,c_n(x)c_n(y)c_n(z)\,e_{nT}(t)\int_0^t e_{nT}(-\tau)\int_0^{L_x}c_n(u)\times$$

$$\times \int\limits_0^{L_y} c_n(v)\int\limits_0^{L_z} s_n(w)\frac{\partial^2 T_{01}(u,v,w,\tau)}{\partial w^2}\frac{d\,w\,d\,v\,d\,u\,d\,\tau}{T_{00}^{\varphi}(u,v,w,\tau)}-2\frac{\pi\,\alpha_{0ass}}{L_x^2 L_y L_z}\sum_{n=1}^{\infty} c_n(x)c_n(y)c_n(z)e_{nT}(t)\int\limits_0^t e_{nT}(-\tau)\times$$

$$\times T_d^{\varphi}\int\limits_0^{L_x} c_n(u)\int\limits_0^{L_y} c_n(v)\int\limits_0^{L_z} c_n(w)\frac{\partial T_{00}(u,v,w,\tau)}{\partial u}\frac{\partial T_{01}(u,v,w,\tau)}{\partial u}\frac{d\,w\,d\,v\,d\,u\,d\,\tau}{T_{00}^{\varphi+1}(u,v,w,\tau)}-2T_d^{\varphi}\frac{\pi\,\alpha_{0ass}}{L_x L_y^2 L_z}\sum_{n=1}^{\infty} c_n(x)\times$$

$$\times c_n(y)c_n(z)e_{nT}(t)\int\limits_0^t e_{nT}(-\tau)\int\limits_0^{L_x} c_n(u)\int\limits_0^{L_y} c_n(v)\int\limits_0^{L_z} c_n(w)\frac{\partial T_{00}(u,v,w,\tau)}{\partial v}\frac{\partial T_{01}(u,v,w,\tau)}{\partial v}\frac{d\,w\,d\,v\,d\,u\,d\,\tau}{T_{00}^{\varphi+1}(u,v,w,\tau)}-$$

$$-2\pi\frac{T_d^{\varphi}\alpha_{0ass}}{L_x L_y L_z^2}\sum_{n=1}^{\infty}\int\limits_0^t e_{nT}(-\tau)\int\limits_0^{L_x} c_n(u)\int\limits_0^{L_y} c_n(v)\int\limits_0^{L_z} c_n(w)\frac{\partial T_{00}(u,v,w,\tau)}{\partial w}\frac{\partial T_{01}(u,v,w,\tau)}{\partial w}\frac{d\,w\,d\,v\,d\,u\,d\,\tau}{T_{00}^{\varphi+1}(u,v,w,\tau)}\times$$

$$\times c_n(x)c_n(y)c_n(z)e_{nT}(t);$$

$$T_{11}(x,y,z,t)=\frac{2\,\alpha_{0ass}}{L_x L_y L_z}\sum_{n=1}^{\infty} c_n(x)c_n(y)c_n(z)e_{nT}(t)\int\limits_0^t e_{nT}(-\tau)\int\limits_0^{L_x} c_n(u)\int\limits_0^{L_y} c_n(v)\int\limits_0^{L_z} c_n(w)\left\{\frac{\partial^2 T_{00}(u,v,w,\tau)}{\partial w^2}\times\right.$$

$$\left.\times g_T(u,v,w,T)+g_T(u,v,w,T)\frac{\partial^2 T_{00}(u,v,w,\tau)}{\partial v^2}+\frac{\partial}{\partial w}\left[g_T(w)\frac{\partial T_{00}(u,v,w,\tau)}{\partial w}\right]\right\}\frac{T_{01}(u,v,w,\tau)}{T_{00}(u,v,w,\tau)}d\,w\,d\,v\,d\,u\,d\,\tau+$$

$$\left.\times\frac{\partial^2 T_{01}(u,v,w,\tau)}{\partial u^2}+\left[1+g_T(u,v,w,T)\right]\frac{\partial^2 T_{01}(u,v,w,\tau)}{\partial v^2}+\frac{\partial}{\partial w}\left[g_T(u,v,w,T)\frac{\partial T_{01}(u,v,w,\tau)}{\partial w}\right]\right\}d\,w\,d\,v\,d\,u\,d\,\tau+$$

$$+2\frac{\alpha_{0ass}T_d^{\varphi}}{L_x L_y L_z}\sum_{n=1}^{\infty} c_n(x)c_n(y)c_n(z)e_{nT}(t)\int\limits_0^t e_{nT}(-\tau)\int\limits_0^{L_x} c_n(u)\int\limits_0^{L_y} c_n(v)\int\limits_0^{L_z}\left[\frac{T_{10}(u,v,w,\tau)}{T_{00}^{\varphi+1}(u,v,w,\tau)}\frac{\partial^2 T_{00}(u,v,w,\tau)}{\partial u^2}+\right.$$

$$\left.\times\frac{T_{10}(u,v,w,\tau)}{T_{00}^{\varphi+1}(u,v,w,\tau)}\frac{\partial^2 T_{00}(u,v,w,\tau)}{\partial v^2}+\frac{T_{10}(u,v,w,\tau)}{T_{00}^{\varphi+1}(u,v,w,\tau)}\frac{\partial^2 T_{00}(u,v,w,\tau)}{\partial w^2}\right]c_n(w)d\,w\,d\,v\,d\,u\,d\,\tau+\frac{\alpha_{0ass}}{L_x L_y}\times$$

$$\times 2\frac{T_d^{\varphi}}{L_z}\sum_{n=1}^{\infty}\int\limits_0^t e_{nT}(-\tau)\int\limits_0^{L_x} c_n(u)\int\limits_0^{L_y} c_n(v)\int\limits_0^{L_z} c_n(w)\left[\frac{\partial^2 T_{10}(u,v,w,\tau)}{\partial u^2}+\frac{\partial^2 T_{10}(u,v,w,\tau)}{\partial v^2}+\frac{\partial^2 T_{10}(u,v,w,\tau)}{\partial w^2}\right]\times$$

$$\times\frac{d\,w\,d\,v\,d\,u\,d\,\tau}{T_{00}^{\varphi}(u,v,w,\tau)}c_n(x)c_n(y)c_n(z)e_{nT}(t)+2\frac{\alpha_{0ass}T_d^{\varphi}}{L_x L_y L_z}2\sum_{n=1}^{\infty} c_n(x)c_n(y)c_n(z)e_{nT}(t)\int\limits_0^t e_{nT}(-\tau)\int\limits_0^{L_x} c_n(u)\int\limits_0^{L_y} c_n(v)\times$$

$$\times\int\limits_0^{L_z} c_n(w)\left\{g_T(u,v,w,T)\frac{\partial^2 T_{00}(u,v,w,\tau)}{\partial u^2}+\frac{\partial}{\partial w}\left[g_T(u,v,w,T)\frac{\partial T_{00}(u,v,w,\tau)}{\partial w}\right]+g_T(u,v,w,T)\times\right.$$

$$\left.\times\frac{\partial^2 T_{00}(u,v,w,\tau)}{\partial v^2}\right\}\frac{d\,w\,d\,v\,d\,u\,d\,\tau}{T_{00}^{\varphi}(u,v,w,\tau)}-2\varphi\frac{\alpha_{0ass}T_d^{\varphi}}{L_x L_y L_z}\sum_{n=1}^{\infty} c_n(x)c_n(y)c_n(z)\,e_{nT}(t)\int\limits_0^t e_{nT}(-\tau)\int\limits_0^{L_x} c_n(u)\int\limits_0^{L_y} c_n(v)\times$$

$$\times\int\limits_0^{L_z} c_n(w)\left\{\left[\frac{\partial T_{00}(u,v,w,\tau)}{\partial u}\right]^2+\left[\frac{\partial T_{00}(u,v,w,\tau)}{\partial v}\right]^2+\left[\frac{\partial T_{00}(u,v,w,\tau)}{\partial w}\right]^2\right\}\frac{d\,w\,d\,v\,d\,u\,d\,\tau}{T_{00}^{\varphi+1}(u,v,w,\tau)}.$$

Integro-differential form of equations of systems (4) could be written as

$$u_x(x,y,z,t)=u_x(x,y,z,t)+\phi\left\{\int\limits_0^t(t-\tau)\int\limits_0^z\left[5\frac{\partial^2 u_x(x,y,w,\tau)}{\partial x^2}-\frac{\partial^2 u_y(x,y,w,\tau)}{\partial x\partial y}-\frac{\partial^2 u_z(x,y,w,\tau)}{\partial x\partial w}\right]\times\right.$$

$$\times\frac{E(w)d\,w\,d\,\tau}{6\left[1+\sigma(w)\right]}-\frac{t}{6}\int\limits_0^{\infty}\int\limits_0^z\left[5\frac{\partial^2 u_x(x,y,w,\tau)}{\partial x^2}-\frac{\partial^2 u_y(x,y,w,\tau)}{\partial x\partial y}-\frac{\partial^2 u_z(x,y,w,\tau)}{\partial x\partial w}\right]\frac{E(w)d\,w}{1+\sigma(w)}d\,\tau-$$

$$-t\int\limits_0^{\infty}\int\limits_0^z K(w)\left[\frac{\partial^2 u_x(x,y,w,\tau)}{\partial x^2}+\frac{\partial^2 u_y(x,y,w,\tau)}{\partial x\partial y}+\frac{\partial^2 u_z(x,y,w,\tau)}{\partial x\partial w}\right]d\,w\,d\,\tau+\frac{1}{2}\int\limits_0^t\int\limits_0^z\left[\frac{\partial^2 u_x(x,y,w,\tau)}{\partial x\partial y}+\right.$$

$$+\frac{\partial^2 u_y(x,y,w,\tau)}{\partial y^2}\Bigg]\frac{E(w)d\,w}{1+\sigma(w)}(t-\tau)\,d\,\tau+\frac{1}{2}\int\limits_0^t(t-\tau)\int\limits_0^z\left[\frac{\partial^2 u_x(x,y,w,\tau)}{\partial x\partial w}+\frac{\partial^2 u_y(x,y,w,\tau)}{\partial w^2}\right]\times$$

$$\times\frac{E(w)d\,w}{1+\sigma(w)}d\,\tau-\frac{t}{2}\int\limits_0^\infty\int\limits_0^z\left[\frac{\partial^2 u_x(x,y,w,\tau)}{\partial x\partial y}+\frac{\partial^2 u_y(x,y,w,\tau)}{\partial y^2}\right]\frac{E(w)d\,w}{1+\sigma(w)}d\,\tau-\int\limits_0^\infty\int\limits_0^z\Bigg[\frac{\partial^2 u_x(x,y,w,\tau)}{\partial x\partial w}+$$

$$+\frac{\partial^2 u_y(x,y,w,\tau)}{\partial w^2}\Bigg]\frac{E(w)d\,w}{1+\sigma(w)}d\,\tau\frac{t}{2}-\int\limits_0^t(t-\tau)\int\limits_0^z\beta(w)K(w)\frac{\partial T(x,y,w,\tau)}{\partial x}d\,w\,d\,\tau+t\int\limits_0^\infty\int\limits_0^z K(w)\times$$

$$\times\beta(w)\frac{\partial T(x,y,w,\tau)}{\partial x}d\,w\,d\,\tau+\int\limits_0^t(t-\tau)\int\limits_0^z\rho(w)\frac{\partial^2 u_x(x,y,w,\tau)}{\partial\tau^2}d\,w\,d\,\tau-\Phi_{x1}(x,y,z,t)-$$

$$-t\int\limits_0^\infty\int\limits_0^z\rho(w)\frac{\partial^2 u_x(x,y,w,\tau)}{\partial\tau^2}d\,w\,d\,\tau\Bigg\},$$

$$u_y(x,y,z,t)=u_y(x,y,z,t)+\phi\Bigg\{\frac{1}{2}\int\limits_0^t(t-\tau)\int\limits_0^z\left[\frac{\partial^2 u_y(x,y,w,\tau)}{\partial x^2}+\frac{\partial^2 u_x(x,y,w,\tau)}{\partial x\partial y}\right]\frac{E(w)d\,w}{1+\sigma(w)}d\,\tau-\frac{t}{2}\times$$

$$\times\int\limits_0^\infty\int\limits_0^z\left[\frac{\partial^2 u_y(x,y,w,\tau)}{\partial x^2}+\frac{\partial^2 u_x(x,y,w,\tau)}{\partial x\partial y}\right]\frac{E(w)d\,w}{1+\sigma(w)}d\,\tau+\frac{1}{6}\int\limits_0^t\int\limits_0^z\Bigg[5\frac{\partial^2 u_y(x,y,w,\tau)}{\partial y^2}-\frac{\partial^2 u_x(x,y,w,\tau)}{\partial x\partial y}-$$

$$-\frac{\partial^2 u_z(x,y,w,\tau)}{\partial y\partial w}\Bigg]\frac{E(w)d\,w}{1+\sigma(w)}(t-\tau)d\,\tau-\int\limits_0^\infty\int\limits_0^z\left[5\frac{\partial^2 u_y(x,y,w,\tau)}{\partial y^2}-\frac{\partial^2 u_x(x,y,w,\tau)}{\partial x\partial y}-\frac{\partial^2 u_z(x,y,w,\tau)}{\partial y\partial w}\right]\times$$

$$\times\frac{E(w)d\,w}{1+\sigma(w)}d\,\tau\frac{t}{6}-\int\limits_0^t(t-\tau)\int\limits_0^z K(w)\beta(w)\frac{\partial T(x,y,w,\tau)}{\partial y}d\,w\,d\,\tau+t\int\limits_0^\infty\int\limits_0^z\beta(w)K(w)\frac{\partial T(x,y,w,\tau)}{\partial y}d\,w\,d\,\tau+$$

$$+\int\limits_0^t(t-\tau)\int\limits_0^z K(w)\left[\frac{\partial^2 u_y(x,y,w,\tau)}{\partial x\partial y}+\frac{\partial^2 u_y(x,y,w,\tau)}{\partial y^2}+\frac{\partial^2 u_y(x,y,w,\tau)}{\partial y\partial w}\right]d\,w\,d\,\tau-t\int\limits_0^\infty\int\limits_0^z K(w)\times$$

$$\times\left[\frac{\partial^2 u_y(x,y,w,\tau)}{\partial x\partial y}+\frac{\partial^2 u_y(x,y,w,\tau)}{\partial y^2}+\frac{\partial^2 u_y(x,y,w,\tau)}{\partial y\partial w}\right]d\,w\,d\,\tau+\int\limits_0^t(t-\tau)\Bigg[\frac{\partial u_y(x,y,z,\tau)}{\partial z}+$$

$$+\frac{\partial u_z(x,y,z,\tau)}{\partial y}\Bigg]d\,\tau\frac{E(z)}{2[1+\sigma(z)]}-\frac{t\,E(z)}{2[1+\sigma(z)]}\int\limits_0^\infty\left[\frac{\partial u_y(x,y,z,\tau)}{\partial z}+\frac{\partial u_z(x,y,z,\tau)}{\partial y}\right]d\,\tau+$$

$$+\int\limits_0^\infty\int\limits_0^z\rho(w)\frac{\partial^2 u_y(x,y,w,\tau)}{\partial\tau^2}d\,w\,d\,\tau-\int\limits_0^t(t-\tau)\int\limits_0^z\rho(w)\frac{\partial^2 u_y(x,y,w,\tau)}{\partial\tau^2}d\,w\,d\,\tau-\Phi_{y1}(x,y,z,t)\Bigg\},$$

$$u_z(x,y,z,t)=u_z(x,y,z,t)+\phi\Bigg\{\frac{1}{2}\int\limits_0^t(t-\tau)\int\limits_0^z\left[\frac{\partial^2 u_z(x,y,w,\tau)}{\partial x^2}+\frac{\partial^2 u_x(x,y,w,\tau)}{\partial x\partial w}\right]\frac{E(w)d\,w}{1+\sigma(w)}d\,\tau-\frac{t}{2}\times$$

$$\times\int\limits_0^\infty\int\limits_0^z\left[\frac{\partial^2 u_z(x,y,w,\tau)}{\partial x^2}+\frac{\partial^2 u_x(x,y,w,\tau)}{\partial x\partial w}\right]\frac{E(w)d\,w}{1+\sigma(w)}d\,\tau+\int\limits_0^t\int\limits_0^z\left[\frac{\partial^2 u_z(x,y,w,\tau)}{\partial y^2}+\frac{\partial^2 u_y(x,y,w,\tau)}{\partial y\partial w}\right]\times$$

$$\times\frac{E(w)d\,w}{1+\sigma(w)}\frac{(t-\tau)}{2}\,d\,\tau-\frac{t}{2}\int\limits_0^\infty\int\limits_0^z\left[\frac{\partial^2 u_z(x,y,w,\tau)}{\partial y^2}+\frac{\partial^2 u_y(x,y,w,\tau)}{\partial y\partial w}\right]\frac{E(w)d\,w}{1+\sigma(w)}d\,\tau-\int\limits_0^t(t-\tau)\int\limits_0^z\beta(w)\times$$

$$\times K(w)\frac{\partial T(x,y,w,\tau)}{\partial w}d\,w\,d\,\tau+t\int\limits_0^\infty\int\limits_0^z K(w)\beta(w)\frac{\partial T(x,y,w,\tau)}{\partial w}d\,w\,d\,\tau+\int\limits_0^t(t-\tau)\Bigg[5\frac{\partial u_z(x,y,z,\tau)}{\partial z}-$$

$$-\frac{\partial u_x(x,y,z,\tau)}{\partial x}-\frac{\partial u_y(x,y,z,\tau)}{\partial y}\Bigg]d\,\tau\frac{E(z)}{6[1+\sigma(z)]}-\frac{E(z)}{1+\sigma(z)}\int\limits_0^\infty\Bigg[5\frac{\partial u_z(x,y,z,\tau)}{\partial z}-\frac{\partial u_x(x,y,z,\tau)}{\partial x}-$$

$$-\frac{\partial u_y(x,y,z,\tau)}{\partial y}\Bigg]d\tau\frac{t}{6}+K(z)\int_0^t(t-\tau)\left[\frac{\partial u_x(x,y,z,\tau)}{\partial x}+\frac{\partial u_y(x,y,z,\tau)}{\partial y}+\frac{\partial u_z(x,y,z,\tau)}{\partial z}\right]d\tau-$$

$$-tK(z)\int_0^\infty\left[\frac{\partial u_x(x,y,z,\tau)}{\partial x}+\frac{\partial u_y(x,y,z,\tau)}{\partial y}+\frac{\partial u_z(x,y,z,\tau)}{\partial z}\right]d\tau-\Phi_{z1}(x,y,z,t)\Bigg\},$$

where $\Phi_{si}(x,y,z,t)=\int_0^z\rho(w)\left[u_s(x,y,w,t)\right]^i dw$, s=x,y,z, ϕ=L/Θ^2E_0, E_0 is the average value of Young modulus.

The second-order approximations of components of displacement vector could be written as

$$u_{x2}(x,y,z,t)=\alpha_{ux2}+u_{x1}(x,y,z,t)+\phi_1\Bigg\{\frac{1}{6}\int_0^t(t-\tau)\int_0^z\left[5\frac{\partial^2u_{x1}(x,y,w,\tau)}{\partial x^2}-\frac{\partial^2u_{y1}(x,y,w,\tau)}{\partial x\partial y}-\right.$$

$$\left.-\frac{\partial^2u_{z1}(x,y,w,\tau)}{\partial x\partial w}\right]\frac{E(w)dw}{1+\sigma(w)}d\tau-\int_0^\infty\int_0^z\left[5\frac{\partial^2u_{x1}(x,y,w,\tau)}{\partial x^2}-\frac{\partial^2u_{y1}(x,y,w,\tau)}{\partial x\partial y}-\frac{\partial^2u_{z1}(x,y,w,\tau)}{\partial x\partial w}\right]\times$$

$$\times\frac{E(w)dw}{1+\sigma(w)}d\tau\frac{t}{6}+\int_0^t(t-\tau)\int_0^zK(w)\left[\frac{\partial^2u_{x1}(x,y,w,\tau)}{\partial x^2}+\frac{\partial^2u_{y1}(x,y,w,\tau)}{\partial x\partial y}+\frac{\partial^2u_{z1}(x,y,w,\tau)}{\partial x\partial w}\right]dw\,d\tau-$$

$$-t\int_0^\infty\int_0^zK(w)\left[\frac{\partial^2u_{x1}(x,y,w,\tau)}{\partial x^2}+\frac{\partial^2u_{y1}(x,y,w,\tau)}{\partial x\partial y}+\frac{\partial^2u_{z1}(x,y,w,\tau)}{\partial x\partial w}\right]dw\,d\tau+\int_0^t\int_0^z\left[\frac{\partial^2u_{x1}(x,y,w,\tau)}{\partial x\partial y}+\right.$$

$$\left.+\frac{\partial^2u_{y1}(x,y,w,\tau)}{\partial y^2}\right]\frac{E(w)dw}{1+\sigma(w)}\frac{(t-\tau)}{2}d\tau+\frac{1}{2}\int_0^t\int_0^z\left[\frac{\partial^2u_{x1}(x,y,w,\tau)}{\partial x\partial y}+\frac{\partial^2u_{y1}(x,y,w,\tau)}{\partial y^2}\right]\frac{E(w)dw}{1+\sigma(w)}\times$$

$$\times(t-\tau)d\tau+\frac{1}{2}\int_0^t(t-\tau)\int_0^z\left[\frac{\partial^2u_{x1}(x,y,w,\tau)}{\partial x\partial w}+\frac{\partial^2u_{y1}(x,y,w,\tau)}{\partial w^2}\right]\frac{E(w)\,dw}{1+\sigma(w)}d\tau-\frac{t}{2}\int_0^\infty\int_0^z\frac{E(w)}{1+\sigma(w)}\times$$

$$\times\left[\frac{\partial^2u_{x1}(x,y,w,\tau)}{\partial x\partial y}+\frac{\partial^2u_{y1}(x,y,w,\tau)}{\partial y^2}\right]dw\,d\tau-\frac{t}{2}\int_0^\infty\int_0^z\left[\frac{\partial^2u_{x1}(x,y,w,\tau)}{\partial x\partial w}+\frac{\partial^2u_{y1}(x,y,w,\tau)}{\partial w^2}\right]\times$$

$$\times\frac{E(w)dw}{1+\sigma(w)}d\tau+t\int_0^\infty\int_0^z\chi(w)\,K(w)\frac{\partial T(x,y,w,\tau)}{\partial x}dw\,d\tau-\int_0^t\int_0^zK(w)\chi(w)\frac{\partial T(x,y,w,\tau)}{\partial x}dw\,(t-$$

$$-\tau)d\tau-\int_0^t(t-\tau)\int_0^z\rho(w)\frac{\partial^2u_{x1}(x,y,w,\tau)}{\partial\tau^2}dw\,d\tau+t\int_0^\infty\int_0^z\rho(w)\frac{\partial^2u_{x1}(x,y,w,\tau)}{\partial\tau^2}dw\,d\tau-$$

$$-\alpha_{ux2}\Phi_{x0}(x,y,z,t)-\Phi_{x1}(x,y,z,t)\Bigg\},$$

$$u_{y2}(x,y,z,t)=\alpha_{uy2}+u_{y1}(x,y,z,t)+\Bigg\{\int_0^t\frac{t-\tau}{2}\int_0^z\left[\frac{\partial^2u_{y1}(x,y,w,\tau)}{\partial x^2}+\frac{\partial^2u_{x1}(x,y,w,\tau)}{\partial x\partial y}\right]\frac{E(w)dw}{1+\sigma(w)}d\tau-$$

$$-\frac{t}{2}\int_0^\infty\int_0^z\left[\frac{\partial^2u_{y1}(x,y,w,\tau)}{\partial x^2}+\frac{\partial^2u_{x1}(x,y,w,\tau)}{\partial x\partial y}\right]\frac{E(w)dw}{1+\sigma(w)}d\tau+\int_0^t\int_0^z\left[5\frac{\partial^2u_{y1}(x,y,w,\tau)}{\partial y^2}-\frac{\partial^2u_{x1}(x,y,w,\tau)}{\partial x\partial y}-\right.$$

$$\left.-\frac{\partial^2u_{z1}(x,y,w,\tau)}{\partial y\partial w}\right]\frac{E(w)dw}{1+\sigma(w)}\frac{t-\tau}{6}d\tau-\int_0^\infty\int_0^z\left[5\frac{\partial^2u_{y1}(x,y,w,\tau)}{\partial y^2}-\frac{\partial^2u_{x1}(x,y,w,\tau)}{\partial x\partial y}-\frac{\partial^2u_{z1}(x,y,w,\tau)}{\partial y\partial w}\right]\times$$

$$\times\frac{E(w)dw}{1+\sigma(w)}d\tau\frac{t}{6}-\int_0^t(t-\tau)\int_0^z\chi(w)K(w)\frac{\partial T(x,y,w,\tau)}{\partial y}dw\,d\tau+t\int_0^\infty\int_0^zK(w)\chi(w)\frac{\partial T(x,y,w,\tau)}{\partial y}dw\,d\tau-$$

$$-\int_0^t (t-\tau)\int_0^z K(w)\left[\frac{\partial^2 u_{y1}(x,y,w,\tau)}{\partial x\partial y}+\frac{\partial^2 u_{y1}(x,y,w,\tau)}{\partial y^2}+\frac{\partial^2 u_{y1}(x,y,w,\tau)}{\partial y\partial w}\right]d\,w\,d\,\tau - t\int_0^\infty\int_0^z K(w)\times$$
$$\times\left[\frac{\partial^2 u_{y1}(x,y,w,\tau)}{\partial x\partial y}+\frac{\partial^2 u_{y1}(x,y,w,\tau)}{\partial y^2}+\frac{\partial^2 u_{y1}(x,y,w,\tau)}{\partial y\partial w}\right]d\,w\,d\,\tau+\frac{1}{2}\int_0^t (t-\tau)\left[\frac{\partial u_{y1}(x,y,z,\tau)}{\partial z}+\right.$$
$$\left.+\frac{\partial u_{z1}(x,y,z,\tau)}{\partial y}\right]d\,\tau\frac{E(z)}{1+\sigma(z)}-\frac{t\,E(z)}{2[1+\sigma(z)]}\int_0^\infty\left[\frac{\partial u_{y1}(x,y,z,\tau)}{\partial z}+\frac{\partial u_{z1}(x,y,z,\tau)}{\partial y}\right]d\,\tau-\alpha_{uy2}\times$$
$$\times\,\Phi_{y\,0}(x,y,z,t)-\Phi_{y\,1}(x,y,z,t)\}\,\phi_{\,1},$$

$$u_{z2}(x,y,z,t)=\alpha_{z2}+u_{z1}(x,y,z,t)+\phi_{\,1}\left\{\frac{1}{2}\int_0^t\int_0^z\left[\frac{\partial^2 u_{z1}(x,y,w,\tau)}{\partial x^2}+\frac{\partial^2 u_{x1}(x,y,w,\tau)}{\partial x\partial w}\right]\frac{E(w)d\,w}{1+\sigma(w)}\times\right.$$
$$\times(t-\tau)d\,\tau-\frac{t}{2}\int_0^\infty\int_0^z\left[\frac{\partial^2 u_{z1}(x,y,w,\tau)}{\partial x^2}+\frac{\partial^2 u_{x1}(x,y,w,\tau)}{\partial x\partial w}\right]\frac{E(w)d\,w}{1+\sigma(w)}d\,\tau+\frac{1}{2}\int_0^t(t-\tau)\int_0^z\left[\frac{\partial^2 u_{z1}(x,y,w,\tau)}{\partial y^2}+\right.$$
$$\left.+\frac{\partial^2 u_{y1}(x,y,w,\tau)}{\partial y\partial w}\right]\frac{E(w)d\,w}{1+\sigma(w)}d\,\tau-\int_0^t(t-\tau)\int_0^z K(w)\chi(w)\frac{\partial T(x,y,w,\tau)}{\partial w}d\,w\,d\,\tau-\int_0^\infty\int_0^z\left[\frac{\partial^2 u_{z1}(x,y,w,\tau)}{\partial y^2}+\right.$$
$$\left.+\frac{\partial^2 u_{y1}(x,y,w,\tau)}{\partial y\partial w}\right]\frac{E(w)d\,w}{1+\sigma(w)}d\,\tau\frac{t}{2}+t\int_0^\infty\int_0^z K(w)\chi(w)\frac{\partial T(x,y,w,\tau)}{\partial w}d\,w\,d\,\tau+\frac{E(z)}{6[1+\sigma(z)]}\int_0^t(t-\tau)\times$$
$$\times\left[5\frac{\partial u_{z1}(x,y,z,\tau)}{\partial z}-\frac{\partial u_{x1}(x,y,z,\tau)}{\partial x}-\frac{\partial u_{y1}(x,y,z,\tau)}{\partial y}\right]d\,\tau-\frac{t}{6}\int_0^\infty\left[5\frac{\partial u_{z1}(x,y,z,\tau)}{\partial z}-\frac{\partial u_{x1}(x,y,z,\tau)}{\partial x}-\right.$$
$$\left.-\frac{\partial u_{y1}(x,y,z,\tau)}{\partial y}\right]d\,\tau\frac{t\,E(z)}{6[1+\sigma(z)]}+\int_0^t(t-\tau)\left[\frac{\partial u_{x1}(x,y,z,\tau)}{\partial x}+\frac{\partial u_{y1}(x,y,z,\tau)}{\partial y}+\frac{\partial u_{z1}(x,y,z,\tau)}{\partial z}\right]d\,\tau\times$$
$$\times K(z)-t\,K(z)\int_0^\infty\left[\frac{\partial u_{x1}(x,y,z,\tau)}{\partial x}+\frac{\partial u_{y1}(x,y,z,\tau)}{\partial y}+\frac{\partial u_{z1}(x,y,z,\tau)}{\partial z}\right]d\,\tau-\alpha_{z2}\Phi_{z\,0}(x,y,z,t)-$$
$$\left.-\,\Phi_{z\,1}(x,y,z,t)\right\}.$$

Calculation of the average values $\alpha_{u\beta 2}$ leads to the following results

$$\alpha_{ux2}=L_z\left\{\frac{1}{12}\int_0^\Theta(\Theta-t)^2\int_0^{L_x}\int_0^{L_y}\int_0^{L_z}\left[5\frac{\partial^2 u_{x1}(x,y,z,t)}{\partial x^2}-\frac{\partial^2 u_{y1}(x,y,z,t)}{\partial x\partial y}-\frac{\partial^2 u_{z1}(x,y,z,t)}{\partial x\partial z}\right]\frac{E(z)d\,z}{1+\sigma(z)}(L_z-\right.$$
$$-z)d\,y\,d\,x\,d\,t-\frac{\Theta^2}{12}\int_0^\infty\int_0^{L_x}\int_0^{L_y}\int_0^{L_z}E(z)\left[5\frac{\partial^2 u_{x1}(x,y,z,t)}{\partial x^2}-\frac{\partial^2 u_{y1}(x,y,z,t)}{\partial x\partial y}-\frac{\partial^2 u_{z1}(x,y,z,t)}{\partial x\partial z}\right]\frac{(L_z-z)}{1+\sigma(z)}\times$$
$$\times d\,z\,d\,y\,d\,x\,d\,t+\frac{1}{2}\int_0^\Theta(\Theta-t)^2\int_0^{L_x}\int_0^{L_y}\int_0^{L_z}(L_z-z)\left[\frac{\partial^2 u_{x1}(x,y,z,t)}{\partial x^2}+\frac{\partial^2 u_{y1}(x,y,z,t)}{\partial x\partial y}+\frac{\partial^2 u_{z1}(x,y,z,t)}{\partial x\partial z}\right]\times$$
$$\times K(z)d\,z\,d\,y\,d\,x\,d\,t-\frac{\Theta^2}{2}\int_0^\infty\int_0^{L_x}\int_0^{L_y}\int_0^{L_z}(L_z-z)\left[\frac{\partial^2 u_{x1}(x,y,z,t)}{\partial x^2}+\frac{\partial^2 u_{y1}(x,y,z,t)}{\partial x\partial y}+\frac{\partial^2 u_{z1}(x,y,z,t)}{\partial x\partial z}\right]\times$$
$$\times K(z)d\,z\,d\,y\,d\,x\,d\,t+\frac{1}{2}\int_0^\Theta(\Theta-t)^2\int_0^{L_x}\int_0^{L_y}\int_0^{L_z}E(z)\left[\frac{\partial^2 u_{x1}(x,y,z,t)}{\partial x\partial y}+\frac{\partial^2 u_{y1}(x,y,z,t)}{\partial y^2}\right]\frac{L_z-z}{1+\sigma(z)}d\,z\,d\,y\times$$

$$\times d\,x\,d\,t+\frac{1}{2}\int\limits_0^{\Theta}(\Theta-t)^2\int\limits_0^{L_x}\int\limits_0^{L_y}\int\limits_0^{L_z}(L_z-z)\left[\frac{\partial^2 u_{x1}(x,y,z,t)}{\partial x\partial z}+\frac{\partial^2 u_{y1}(x,y,z,t)}{\partial z^2}\right]\frac{E(z)d\,z}{1+\sigma(z)}d\,y\,d\,x\,d\,t-\frac{\Theta^2}{4}\times$$

$$\times\int\limits_0^{\infty}\int\limits_0^{L_x}\int\limits_0^{L_y}\int\limits_0^{L_z}E(z)\frac{(L_z-z)}{1+\sigma(z)}\left[\frac{\partial^2 u_{x1}(x,y,z,t)}{\partial x\partial y}+\frac{\partial^2 u_{y1}(x,y,z,t)}{\partial y^2}\right]d\,z\,d\,y\,d\,x\,d\,t+\frac{1}{4}\int\limits_0^{\Theta}(\Theta-t)^2\int\limits_0^{L_x}\int\limits_0^{L_y}\int\limits_0^{L_z}\frac{L_z-z}{1+\sigma(z)}\times$$

$$\times\left[\frac{\partial^2 u_{x1}(x,y,z,t)}{\partial x\partial z}+\frac{\partial^2 u_{y1}(x,y,z,t)}{\partial z^2}\right]E(z)d\,z\,d\,y\,d\,x\,d\,t+\int\limits_0^{\infty}\int\limits_0^{L_x}\int\limits_0^{L_y}\int\limits_0^{L_z}(L_z-z)\frac{\rho(z)}{2}\frac{\partial^2 u_{x1}(x,y,z,t)}{\partial t^2}\times$$

$$\times\Theta^2 d\,z\,d\,y\,d\,x\,d\,t-\int\limits_0^{\Theta}(\Theta-t)\int\limits_0^{L_x}\int\limits_0^{L_y}\int\limits_0^{L_z}(L_z-z)\rho(z)\,u_{x1}(x,y,z,t)\,d\,z\,d\,y\,d\,x\,d\,t+\frac{\Theta^2}{2}\int\limits_0^{\infty}\int\limits_0^{L_x}\int\limits_0^{L_y}\int\limits_0^{L_z}(L_z-z)\times$$

$$\times\frac{\partial^2 u_{x1}(x,y,z,t)}{\partial t^2}d\,z\,d\,y\,d\,x\,d\,t+\frac{\Theta^2}{2}\mathrm{X}_{x\,0}(\infty)-\frac{1}{2}\mathrm{X}_{x\,2}(\Theta)\Bigg\}\Bigg/\left[4\,\Theta\,L\int\limits_0^{L_z}(L_z-z)\,\rho\,(z)\,d\,z\right],$$

$$\alpha_{uy2}=L_z\left\{\frac{1}{2}\int\limits_0^{\Theta}(\Theta-\tau)^2\int\limits_0^{L_x}\int\limits_0^{L_y}\int\limits_0^{L_z}E(z)\frac{(L_z-z)}{1+\sigma(z)}\left[\frac{\partial^2 u_{y1}(x,y,z,t)}{\partial x^2}+\frac{\partial^2 u_{x1}(x,y,z,t)}{\partial x\partial y}\right]d\,z\,d\,y\,d\,x\,d\,t-\frac{\Theta^2}{2}\times\right.$$

$$\times\int\limits_0^{\infty}\int\limits_0^{L_x}\int\limits_0^{L_y}\int\limits_0^{L_z}E(z)\frac{(L_z-z)}{1+\sigma(z)}\left[\frac{\partial^2 u_{y1}(x,y,z,t)}{\partial x^2}+\frac{\partial^2 u_{x1}(x,y,z,t)}{\partial x\partial y}\right]d\,z\,d\,y\,d\,x\,d\,t+\frac{1}{12}\int\limits_0^{\Theta}\int\limits_0^{L_x}\int\limits_0^{L_y}\int\limits_0^{L_z}E(z)\frac{L_z-z}{1+\sigma(z)}\times$$

$$\times\left[5\frac{\partial^2 u_{y1}(x,y,z,t)}{\partial y^2}-\frac{\partial^2 u_{x1}(x,y,z,t)}{\partial x\partial y}-\frac{\partial^2 u_{z1}(x,y,z,t)}{\partial y\partial z}\right]d\,z\,d\,y\,d\,x(\Theta-\tau)^2\,d\,t-\frac{\Theta^2}{12}\int\limits_0^{\infty}\int\limits_0^{L_x}\int\limits_0^{L_y}\int\limits_0^{L_z}E(z)\times$$

$$\times\frac{L_z-z}{1+\sigma(z)}\left[5\frac{\partial^2 u_{y1}(x,y,z,t)}{\partial y^2}-\frac{\partial^2 u_{x1}(x,y,z,t)}{\partial x\partial y}-\frac{\partial^2 u_{z1}(x,y,z,t)}{\partial y\partial z}\right]d\,z\,d\,y\,d\,x\,d\,t+\int\limits_0^{\Theta}(\Theta-t)^2\int\limits_0^{L_x}\int\limits_0^{L_y}\int\limits_0^{L_z}\frac{K(z)}{2}\times$$

$$\times(L_z-z)\left[\frac{\partial^2 u_{y1}(x,y,z,t)}{\partial x\partial y}+\frac{\partial^2 u_{y1}(x,y,z,t)}{\partial y^2}+\frac{\partial^2 u_{y1}(x,y,z,t)}{\partial y\partial z}\right]d\,z\,d\,y\,d\,x\,d\,t-\int\limits_0^{\infty}\int\limits_0^{L_x}\int\limits_0^{L_y}\int\limits_0^{L_z}K(z)\,(L_z-z)\times$$

$$\times\frac{\Theta^2}{2}\left[\frac{\partial^2 u_{y1}(x,y,z,t)}{\partial x\partial y}+\frac{\partial^2 u_{y1}(x,y,z,t)}{\partial y^2}+\frac{\partial^2 u_{y1}(x,y,z,t)}{\partial y\partial z}\right]d\,z\,d\,y\,d\,x\,d\,t+\frac{1}{2}\int\limits_0^{\Theta}\int\limits_0^{L_x}\int\limits_0^{L_y}\int\limits_0^{L_z}\left[\frac{\partial u_{y1}(x,y,z,t)}{\partial z}+\right.$$

$$\left.+\frac{\partial u_{z1}(x,y,z,t)}{\partial y}\right]\frac{E(z)d\,z}{1+\sigma(z)}d\,y\,d\,x(\Theta-\tau)^2\,d\,t-\frac{\Theta^2}{2}\int\limits_0^{\infty}\int\limits_0^{L_x}\int\limits_0^{L_y}\int\limits_0^{L_z}\left[\frac{\partial u_{y1}(x,y,z,t)}{\partial z}+\frac{\partial u_{z1}(x,y,z,t)}{\partial y}\right]\frac{E(z)d\,z}{1+\sigma(z)}\times$$

$$\times\,d\,y\,d\,x\,d\,t-\frac{1}{2}\int\limits_0^{\Theta}(\Theta-t)^2\int\limits_0^{L_x}\int\limits_0^{L_y}\int\limits_0^{L_z}\rho(z)\frac{\partial^2 u_{y1}(x,y,z,t)}{\partial t^2}d\,z\,d\,y\,d\,x\,d\,t+\frac{\Theta^2}{2}\int\limits_0^{\infty}\int\limits_0^{L_x}\int\limits_0^{L_y}\int\limits_0^{L_z}\frac{\partial^2 u_{y1}(x,y,z,t)}{\partial t^2}\times$$

$$\left.\times\rho(z)\,d\,z\,d\,y\,d\,x\,d\,t-\int\limits_0^{\Theta}\int\limits_0^{L_x}\int\limits_0^{L_y}\int\limits_0^{L_z}(L_z-z)\rho(z)\,u_{y1}(x,y,z,t)d\,z\,d\,y\,d\,x\,d\,t-\frac{\mathrm{X}_{y\,2}(\Theta)}{2}+\Theta^2\,\frac{\mathrm{X}_{y\,0}(\infty)}{2}\right\}\times$$

$$\times\left[4\,\Theta\,L\int\limits_0^{L_z}(L_z-z)\,\rho\,(z)\,d\,z\right]^{-1},$$

$$\alpha_{z2}=L_z\left\{\frac{1}{2}\int\limits_0^{\Theta}(\Theta-t)^2\int\limits_0^{L_x}\int\limits_0^{L_y}\int\limits_0^{L_z}E(z)\frac{(L_z-z)}{1+\sigma(z)}\left[\frac{\partial^2 u_{z1}(x,y,z,t)}{\partial x^2}+\frac{\partial^2 u_{x1}(x,y,z,t)}{\partial x\partial z}\right]d\,z\,d\,y\,d\,x\,d\,t-\frac{\Theta^2}{2}\times\right.$$

$$\times\int\limits_0^{\infty}\int\limits_0^{L_x}\int\limits_0^{L_y}\int\limits_0^{L_z}E(z)\frac{(L_z-z)}{1+\sigma(z)}\left[\frac{\partial^2 u_{z1}(x,y,z,t)}{\partial x^2}+\frac{\partial^2 u_{x1}(x,y,z,t)}{\partial x\partial z}\right]d\,z\,d\,y\,d\,x\,d\,t+\frac{1}{2}\int\limits_0^{\Theta}(\Theta-t)^2\int\limits_0^{L_x}\int\limits_0^{L_y}\int\limits_0^{L_z}E(z)\times$$

$$\times\left[\frac{\partial^2 u_{z1}(x,y,z,t)}{\partial y^2}+\frac{\partial^2 u_{y1}(x,y,z,t)}{\partial y\partial z}\right]d\,z\,d\,y\,d\,x\,d\,t-\int\limits_0^{\infty}\int\limits_0^{L_x}\int\limits_0^{L_y}\int\limits_0^{L_z}\left[\frac{\partial^2 u_{z1}(x,y,z,t)}{\partial y^2}+\frac{\partial^2 u_{y1}(x,y,z,t)}{\partial y\partial z}\right]\times$$

$$\times\Theta^2\frac{E(z)\,(L_z-z)}{2\,[1+\sigma(z)]}\,d\,z\,d\,y\,d\,x\,d\,t+\frac{1}{12}\int\limits_0^{\Theta}\int\limits_0^{L_x}\int\limits_0^{L_y}\int\limits_0^{L_z}\left[5\frac{\partial u_{z1}(x,y,z,t)}{\partial z}-\frac{\partial u_{x1}(x,y,z,t)}{\partial x}-\frac{\partial u_{y1}(x,y,z,t)}{\partial y}\right]\times$$
$$\times\frac{E(z)d\,z}{1+\sigma(z)}\,d\,y\,d\,x\,(\Theta-t)^2\,d\,t-\frac{\Theta^2}{12}\int\limits_0^{\infty}\int\limits_0^{L_x}\int\limits_0^{L_y}\int\limits_0^{L_z}\left[5\frac{\partial u_{z1}(x,y,z,t)}{\partial z}-\frac{\partial u_{x1}(x,y,z,t)}{\partial x}-\frac{\partial u_{y1}(x,y,z,t)}{\partial y}\right]\times$$
$$\times\frac{E(z)d\,z}{1+\sigma(z)}\,d\,y\,d\,x\,d\,t+\int\limits_0^{\Theta}(\Theta-t)^2\int\limits_0^{L_x}\int\limits_0^{L_y}\int\limits_0^{L_z}\frac{K(z)}{2}\left[\frac{\partial u_{x1}(x,y,z,t)}{\partial x}+\frac{\partial u_{y1}(x,y,z,t)}{\partial y}+\frac{\partial u_{z1}(x,y,z,t)}{\partial z}\right]\times$$
$$\times\,d\,z\,d\,y\,d\,x\,d\,t-\frac{X_{z2}(\Theta)}{2}-\frac{\Theta^2}{2}\int\limits_0^{\infty}\int\limits_0^{L_x}\int\limits_0^{L_y}\int\limits_0^{L_z}K(z)\left[\frac{\partial u_{x1}(x,y,z,t)}{\partial x}+\frac{\partial u_{y1}(x,y,z,t)}{\partial y}+\frac{\partial u_{z1}(x,y,z,t)}{\partial z}\right]\times$$
$$\left.\times d\,z\,d\,y\,d\,x\,d\,t-\int\limits_0^{\Theta}\int\limits_0^{L_x}\int\limits_0^{L_y}\int\limits_0^{L_z}(L_z-z)\,u_{z1}(x,y,z,t)\rho\,(z)\,d\,z\,d\,y\,d\,x\,d\,t+\Theta^2\frac{X_{z0}(\infty)}{2}\right\}\left\{4\int\limits_0^{L_z}(L_z-z)\times\right.$$
$$\left.\times\,\rho\,(z)\,d\,z\,\Theta\,L\right\}^{-1}.$$

System of equations for the functions $C_{ijk}(x,y,z,t)$ ($i\ge0$, $j\ge0$, $k\ge0$) could be written as

$$\frac{\partial C_{000}(x,y,z,t)}{\partial t}=D_{0L}\left[\frac{\partial^2 C_{000}(x,y,z,t)}{\partial x^2}+\frac{\partial^2 C_{000}(x,y,z,t)}{\partial y^2}+\frac{\partial^2 C_{000}(x,y,z,t)}{\partial z^2}\right];$$
$$\frac{\partial C_{i00}(x,y,z,t)}{\partial t}=D_{0L}\left(\left\{\frac{\partial}{\partial x}\left[g_L\,(z,T)\frac{\partial C_{i-100}(x,y,z,t)}{\partial x}\right]+\frac{\partial}{\partial y}\left[g_L\,(z,T)\frac{\partial C_{i-100}(x,y,z,t)}{\partial y}\right]+\right.\right.$$
$$\left.\left.+\frac{\partial}{\partial z}\left[g_L\,(z,T)\frac{\partial C_{i-100}(x,y,z,t)}{\partial z}\right]\right\}+\left[\frac{\partial^2 C_{i00}(x,y,z,t)}{\partial x^2}+\frac{\partial^2 C_{i00}(x,y,z,t)}{\partial y^2}+\frac{\partial^2 C_{i00}(x,y,z,t)}{\partial z^2}\right]\right),\ i\ge1;$$
$$\frac{\partial C_{010}(x,y,z,t)}{\partial t}=D_{0L}\left[\frac{\partial^2 C_{010}(x,y,z,t)}{\partial x^2}+\frac{\partial^2 C_{010}(x,y,z,t)}{\partial y^2}+\frac{\partial^2 C_{010}(x,y,z,t)}{\partial z^2}\right]+$$
$$+D_{0L}\left\{\frac{\partial}{\partial x}\left[\frac{C^{\gamma}_{000}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\frac{\partial C_{000}(x,y,z,t)}{\partial x}\right]+\frac{\partial}{\partial y}\left[\frac{C^{\gamma}_{000}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\frac{\partial C_{000}(x,y,z,t)}{\partial y}\right]+\right.$$
$$\left.+\frac{\partial}{\partial z}\left[\frac{C^{\gamma}_{000}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\frac{\partial C_{000}(x,y,z,t)}{\partial z}\right]\right\};$$
$$\frac{\partial C_{020}(x,y,z,t)}{\partial t}=D_{0L}\left[\frac{\partial^2 C_{020}(x,y,z,t)}{\partial x^2}+\frac{\partial^2 C_{020}(x,y,z,t)}{\partial y^2}+\frac{\partial^2 C_{020}(x,y,z,t)}{\partial z^2}\right]+D_{0L}\times$$
$$\times\left\{\frac{\partial}{\partial x}\left[C_{010}(x,y,z,t)\frac{C^{\gamma-1}_{000}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\frac{\partial C_{000}(x,y,z,t)}{\partial y}\right]+\frac{\partial}{\partial y}\left[C_{010}(x,y,z,t)\frac{\partial C_{000}(x,y,z,t)}{\partial y}\times\right.\right.$$
$$\left.\left.\times\frac{C^{\gamma-1}_{000}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\right]+\frac{\partial}{\partial z}\left[C_{010}(x,y,z,t)\frac{C^{\gamma-1}_{000}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\frac{\partial C_{000}(x,y,z,t)}{\partial z}\right]\right\}+D_{0L}\left\{\frac{\partial}{\partial x}\frac{C^{\gamma}_{000}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\times\right.$$
$$\left.\times\frac{\partial C_{010}(x,y,z,t)}{\partial x}\right]+\frac{\partial}{\partial y}\left[\frac{C^{\gamma}_{000}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\frac{\partial C_{010}(x,y,z,t)}{\partial y}\right]+\frac{\partial}{\partial z}\left[\frac{C^{\gamma}_{000}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\frac{\partial C_{010}(x,y,z,t)}{\partial z}\right]\right\};$$
$$\frac{\partial C_{001}(x,y,z,t)}{\partial t}=D_{0L}\left[\frac{\partial^2 C_{001}(x,y,z,t)}{\partial x^2}+\frac{\partial^2 C_{001}(x,y,z,t)}{\partial y^2}+\frac{\partial^2 C_{001}(x,y,z,t)}{\partial z^2}\right]+$$

$$+\Omega D_{0SL}\frac{\partial}{\partial x}\left\{\left[1+\varepsilon_{SL}g_{SL}(x,y,z,T)\right]\left[1+\xi_S\frac{C_{000}^{\gamma}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\right]\int_0^{L_z}C_{000}(x,y,W,t)\,dW\frac{\nabla_S\mu(x,y,z,t)}{kT}\right\}+$$

$$+\Omega D_{0SL}\frac{\partial}{\partial y}\left\{\left[1+\varepsilon_{SL}g_{SL}(x,y,z,T)\right]\left[1+\xi_S\frac{C_{000}^{\gamma}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\right]\int_0^{L_z}C_{000}(x,y,W,t)\,dW\frac{\nabla_S\mu(x,y,z,t)}{kT}\right\};$$

$$\frac{\partial C_{002}(x,y,z,t)}{\partial t}=D_{0L}\left[\frac{\partial^2 C_{002}(x,y,z,t)}{\partial x^2}+\frac{\partial^2 C_{002}(x,y,z,t)}{\partial y^2}+\frac{\partial^2 C_{002}(x,y,z,t)}{\partial z^2}\right]+$$

$$+\Omega D_{0SL}\frac{\partial}{\partial x}\left\{\left[1+\varepsilon_{SL}g_{SL}(x,y,z,T)\right]\left[1+\xi_S\frac{C_{000}^{\gamma}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\right]\int_0^{L_z}C_{001}(x,y,W,t)\,dW\frac{\nabla_S\mu(x,y,z,t)}{kT}\right\}+$$

$$+\Omega D_{0SL}\frac{\partial}{\partial y}\left\{\left[1+\varepsilon_{SL}g_{SL}(x,y,z,T)\right]\left[1+\xi_S\frac{C_{000}^{\gamma}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\right]\int_0^{L_z}C_{001}(x,y,W,t)\,dW\frac{\nabla_S\mu(x,y,z,t)}{kT}\right\}+$$

$$+\Omega D_{0SL}\frac{\partial}{\partial x}\left\{\left[1+\varepsilon_{SL}g_{SL}(x,y,z,T)\right]\left[1+\xi_S C_{001}^{\gamma}(x,y,z,t)\frac{C_{000}^{\gamma-1}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\right]\int_0^{L_z}C_{000}(x,y,W,t)\,dW\times\right.$$

$$\left.\times\frac{\nabla_S\mu(x,y,z,t)}{kT}\right\}+\frac{\partial}{\partial y}\left\{\left[1+\xi_S C_{001}^{\gamma}(x,y,z,t)\frac{C_{000}^{\gamma-1}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\right]\frac{\nabla_S\mu(x,y,z,t)}{kT}\int_0^{L_z}C_{000}(x,y,W,t)\,dW\times\right.$$

$$\left.\times\left[1+\varepsilon_{SL}g_{SL}(x,y,z,T)\right]\right\}\Omega D_{0SL};$$

$$\frac{\partial C_{110}(x,y,z,t)}{\partial t}=D_{0L}\left[\frac{\partial^2 C_{110}(x,y,z,t)}{\partial x^2}+\frac{\partial^2 C_{110}(x,y,z,t)}{\partial y^2}+\frac{\partial^2 C_{110}(x,y,z,t)}{\partial z^2}\right]+\left\{\frac{\partial}{\partial x}\left[\frac{\partial C_{010}(x,y,z,t)}{\partial x}\times\right.\right.$$

$$\left.\left.\times g_L(x,y,z,T)\right]+\frac{\partial}{\partial y}\left[g_L(x,y,z,T)\frac{\partial C_{010}(x,y,z,t)}{\partial y}\right]+\frac{\partial}{\partial z}\left[g_L(x,y,z,T)\frac{\partial C_{010}(x,y,z,t)}{\partial z}\right]\right\}D_{0L}+$$

$$+\left\{\frac{\partial}{\partial x}\left[\frac{C_{000}^{\gamma}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\frac{\partial C_{100}(x,y,z,t)}{\partial x}\right]+\frac{\partial}{\partial y}\left[\frac{C_{000}^{\gamma}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\frac{\partial C_{100}(x,y,z,t)}{\partial y}\right]+\frac{\partial}{\partial z}\left[\frac{C_{000}^{\gamma}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\times\right.\right.$$

$$\left.\left.\times\frac{\partial C_{100}(x,y,z,t)}{\partial z}\right]\right\}D_{0L}+\left\{\frac{\partial}{\partial x}\left[C_{100}(x,y,z,t)\frac{C_{000}^{\gamma-1}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\frac{\partial C_{000}(x,y,z,t)}{\partial x}\right]+\frac{\partial}{\partial y}\left[\frac{C_{000}^{\gamma-1}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\times\right.\right.$$

$$\left.\left.\times C_{100}(x,y,z,t)\frac{\partial C_{000}(x,y,z,t)}{\partial y}\right]+\frac{\partial}{\partial z}\left[C_{100}(x,y,z,t)\frac{C_{000}^{\gamma-1}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\frac{\partial C_{000}(x,y,z,t)}{\partial z}\right]\right\}D_{0L};$$

$$\frac{\partial C_{101}(x,y,z,t)}{\partial t}=D_{0L}\left[\frac{\partial^2 C_{100}(x,y,z,t)}{\partial x^2}+\frac{\partial^2 C_{100}(x,y,z,t)}{\partial y^2}+\frac{\partial^2 C_{100}(x,y,z,t)}{\partial z^2}\right]+\left\{\frac{\partial}{\partial x}\left[\frac{\partial C_{000}(x,y,z,t)}{\partial y}\times\right.\right.$$

$$\left.\left.\times g_L(x,y,z,T)\right]+\frac{\partial}{\partial y}\left[g_L(x,y,z,T)\frac{\partial C_{000}(x,y,z,t)}{\partial y}\right]+\frac{\partial}{\partial z}\left[g_L(x,y,z,T)\frac{\partial C_{000}(x,y,z,t)}{\partial z}\right]\right\}D_{0L}+$$

$$+\Omega D_{0SL}\frac{\partial}{\partial x}\left\{\left[1+\varepsilon_{SL}g_{SL}(x,y,z,T)\right]\left[1+\xi_S C_{100}(x,y,z,t)\frac{C_{000}^{\gamma-1}(x,y,z,t)}{P^{\gamma}(z,T)}\right]\int_0^{L_z}C_{100}(x,y,W,t)\,dW\times\right.$$

$$\left.\times\frac{\nabla_S\mu(x,y,z,t)}{kT}\right\}+\Omega D_{0SL}\frac{\partial}{\partial y}\left\{\left[1+\varepsilon_{SL}g_{SL}(x,y,z,T)\right]\left[1+\xi_S C_{100}(x,y,z,t)\frac{C_{000}^{\gamma-1}(x,y,z,t)}{P^{\gamma}(z,T)}\right]\times\right.$$

$$\left.\times\int_0^{L_z}C_{100}(x,y,W,t)\,dW\frac{\nabla_S\mu(x,y,z,t)}{kT}\right\}+\frac{\partial}{\partial x}\left\{\left[1+\varepsilon_{SL}g_{SL}(x,y,z,T)\right]\int_0^{L_z}C_{100}(x,y,W,t)\,dW\times\right.$$

$$\times\frac{\nabla_S\mu\left(x,y,z,t\right)}{kT}\int\limits_0^{L_z}C_{100}(x,y,W,t)\,d\,W\Bigg\}\,\Omega\,D_{0SL}+\frac{\partial}{\partial\,y}\Bigg\{\left[1+\varepsilon_{SL}g_{SL}\left(x,y,z,T\right)\right]\frac{\nabla_S\mu\left(x,y,z,t\right)}{kT}\times$$

$$\times\int\limits_0^{L_z}C_{100}(x,y,W,t)\,d\,W\int\limits_0^{L_z}C_{100}(x,y,W,t)\,d\,W\Bigg\}\Omega\,D_{0SL};$$

$$\frac{\partial C_{011}(x,y,z,t)}{\partial t}=D_{0L}\left[\frac{\partial^2C_{011}(x,y,z,t)}{\partial x^2}+\frac{\partial^2C_{011}(x,y,z,t)}{\partial y^2}+\frac{\partial^2C_{011}(x,y,z,t)}{\partial z^2}\right]+\left\{\frac{\partial}{\partial x}\left[\frac{C_{000}^{\gamma}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\times\right.\right.$$

$$\left.\left.\times\frac{\partial C_{001}(x,y,z,t)}{\partial x}\right]+\frac{\partial}{\partial y}\left[\frac{C_{000}^{\gamma}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\frac{\partial C_{001}(x,y,z,t)}{\partial y}\right]+\frac{\partial}{\partial z}\left[\frac{C_{000}^{\gamma}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\frac{\partial C_{001}(x,y,z,t)}{\partial z}\right]\right\}D_{0L}+$$

$$+D_{0L}\left\{\frac{\partial}{\partial x}\left[C_{001}(x,y,z,t)\frac{C_{000}^{\gamma-1}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\frac{\partial C_{000}(x,y,z,t)}{\partial x}\right]+\frac{\partial}{\partial y}\left[C_{001}(x,y,z,t)\frac{\partial C_{000}(x,y,z,t)}{\partial y}\times\right.\right.$$

$$\left.\left.\times\frac{C_{000}^{\gamma-1}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\right]+\frac{\partial}{\partial z}\left[C_{001}(x,y,z,t)\frac{C_{000}^{\gamma-1}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\frac{\partial C_{000}(x,y,z,t)}{\partial z}\right]\right\}+\frac{\partial}{\partial x}\left\{\frac{\nabla_S\mu\left(x,y,z,t\right)}{kT}\times\right.$$

$$\times\left[1+\varepsilon_{SL}g_{SL}\left(x,y,z,T\right)\right]\left[1+\xi_S\frac{C_{000}^{\gamma}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\right]\int\limits_0^{L_z}C_{010}(x,y,W,t)\,d\,W\Bigg\}\Omega\,D_{0SL}+\frac{\partial}{\partial x}\left\{\frac{\nabla_S\mu\left(x,y,z,t\right)}{kT}\times\right.$$

$$\times\left[1+\varepsilon_{SL}g_{SL}\left(x,y,z,T\right)\right]\left[1+\xi_SC_{010}(x,y,z,t)\frac{C_{000}^{\gamma-1}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\right]\int\limits_0^{L_z}C_{000}(x,y,W,t)\,d\,W\Bigg\}\Omega\,D_{0SL}+D_{0SL}\Omega\times$$

$$\times\frac{\partial}{\partial y}\left\{\left[1+\varepsilon_{SL}g_{SL}\left(x,y,z,T\right)\right]\left[1+\xi_SC_{010}(x,y,z,t)\frac{C_{000}^{\gamma-1}(x,y,z,t)}{P^{\gamma}(x,y,z,T)}\right]\frac{\nabla_S\mu\left(x,y,z,t\right)}{kT}\int\limits_0^{L_z}C_{000}(x,y,W,t)\,d\,W\right\}.$$

Boundary and initial conditions for functions $C_{ijk}(x,t)$ ($i\geq0$, $j\geq0$, $k\geq0$) could be written as

$$\left.\frac{\partial C_{ijk}(x,y,z,t)}{\partial x}\right|_{x=0}=0;\ \left.\frac{\partial C_{ijk}(x,y,z,t)}{\partial x}\right|_{x=L_x}=0;\ \left.\frac{\partial C_{ijk}(x,y,z,t)}{\partial y}\right|_{y=0}=0;\ \left.\frac{\partial C_{ijk}(x,y,z,t)}{\partial y}\right|_{y=L_y}=0;$$

$$\left.\frac{\partial C_{ijk}(x,y,z,t)}{\partial z}\right|_{z=0}=0;\ \left.\frac{\partial C_{ijk}(x,y,z,t)}{\partial z}\right|_{z=L_z}=0;\ C_{000}(x,y,z,0)=f_C\,(x,y,z);\ C_{ijk}(x,y,z,0)=0.$$

Solutions of equations for functions $C_{ijk}(x,t)$ ($i\geq0$, $j\geq0$, $k\geq0$) could be written as

$$C_{000}(x,y,z,t)=\frac{F_{0C}}{L_xL_yL_z}+\frac{2}{L_xL_yL_z}\sum_{n=1}^{\infty}F_{nC}c_n(x)c_n(y)c_n(z)e_{nC}(t),$$

where $e_{nC}(t)=\exp\left[-\pi^2n^2D_{0L}t\left(\frac{1}{L_x^2}+\frac{1}{L_y^2}+\frac{1}{L_z^2}\right)\right]$, $F_{nC}=\int\limits_0^{L_x}c_n(u)\int\limits_0^{L_y}c_n(v)\int\limits_0^{L_z}c_n(w)\ f_C(u,v,w)\,d\,w\,d\,v\,d\,u$;

$$C_{i00}(x,y,z,t)=-\frac{2\pi\,D_{0L}}{L_x^2L_yL_z}\sum_{n=1}^{\infty}n\,F_{nC}c_n(x)c_n(y)c_n(z)e_{nC}(t)\int\limits_0^te_{nC}(-\tau)\int\limits_0^{L_x}s_n(u)\int\limits_0^{L_y}c_n(v)\int\limits_0^{L_z}g_L(u,v,w,T)\times$$

$$\times c_n(w)\frac{\partial C_{i-100}(u,v,w,\tau)}{\partial u}d\,w\,d\,v\,d\,u\,d\,\tau-\frac{2\pi\,D_{0L}}{L_xL_y^2L_z}\sum_{n=1}^{\infty}n\,F_{nC}c_n(x)c_n(y)c_n(z)e_{nC}(t)\int\limits_0^te_{nC}(-\tau)\int\limits_0^{L_x}c_n(u)\times$$

$$\times\int\limits_0^{L_y}s_n(v)\int\limits_0^{L_z}c_n(w)g_L(u,v,w,T)\frac{\partial C_{i-100}(u,v,w,\tau)}{\partial v}d\,w\,d\,v\,d\,u\,d\,\tau-\frac{2\pi\,D_{0L}}{L_xL_yL_z^2}\sum_{n=1}^{\infty}c_n(x)c_n(y)c_n(z)e_{nC}(t)\times$$

$$\times n F_{nC} \int_0^t e_{nC}(-\tau) \int_0^{L_x} c_n(u) \int_0^{L_y} c_n(v) \int_0^{L_z} s_n(w)\ g_L(u,v,w,T) \frac{\partial C_{i-100}(u,v,w,\tau)}{\partial w} d\,w\,d\,v\,d\,u\,d\,\tau\ ,\ i \geq 1;$$

$$C_{010}(x,y,z,t) = -\frac{2\pi D_{0L}}{L_x^2 L_y L_z} \sum_{n=1}^{\infty} n F_{nC} c_n(x) c_n(y) c_n(z) e_{nC}(t) \int_0^t e_{nC}(-\tau) \int_0^{L_x} s_n(u) \int_0^{L_y} c_n(v) \int_0^{L_z} \frac{C_{000}^{\gamma}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)} \times$$

$$\times c_n(w) \frac{\partial C_{000}(u,v,w,\tau)}{\partial u} d\,w\,d\,v\,d\,u\,d\,\tau - \frac{2\pi D_{0L}}{L_x L_y^2 L_z} \sum_{n=1}^{\infty} n F_{nC} c_n(x) c_n(y) c_n(z) e_{nC}(t) \int_0^t e_{nC}(-\tau) \int_0^{L_x} c_n(u) \times$$

$$\times \int_0^{L_y} s_n(v) \int_0^{L_z} c_n(w) \int_0^{L_z} c_n(w) \frac{C_{000}^{\gamma}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)} \frac{\partial C_{000}(u,v,w,\tau)}{\partial v} d\,w\,d\,v\,d\,u\,d\,\tau - \frac{2\pi D_{0L}}{L_x L_y L_z^2} \sum_{n=1}^{\infty} n c_n(x) c_n(y) \times$$

$$\times F_{nC} c_n(z) e_{nC}(t) \int_0^t e_{nC}(-\tau) \int_0^{L_x} c_n(u) \int_0^{L_y} c_n(v) \int_0^{L_z} s_n(w) \frac{C_{000}^{\gamma}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)} \frac{\partial C_{000}(u,v,w,\tau)}{\partial w} d\,w\,d\,v\,d\,u\,d\,\tau\,;$$

$$C_{020}(x,y,z,t) = -\frac{2\pi D_{0L}}{L_x^2 L_y L_z} \sum_{n=1}^{\infty} n F_{nC} c_n(x) c_n(y) c_n(z) e_{nC}(t) \int_0^t e_{nC}(-\tau) \int_0^{L_x} s_n(u) \int_0^{L_y} c_n(v) \int_0^{L_z} C_{010}(u,v,w,\tau) \times$$

$$\times c_n(w) \frac{C_{000}^{\gamma-1}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)} \frac{\partial C_{000}(u,v,w,\tau)}{\partial u} d\,w\,d\,v\,d\,u\,d\,\tau - \frac{2\pi D_{0L}}{L_x L_y^2 L_z} \sum_{n=1}^{\infty} n F_{nC} c_n(x) c_n(y) c_n(z) e_{nC}(t) \times$$

$$\times \int_0^t e_{nC}(-\tau) \int_0^{L_x} s_n(u) \int_0^{L_y} c_n(v) \int_0^{L_z} c_n(w)\ C_{010}(u,v,w,\tau) \frac{C_{000}^{\gamma-1}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)} \frac{\partial C_{000}(u,v,w,\tau)}{\partial v} d\,w\,d\,v\,d\,u\,d\,\tau -$$

$$-\sum_{n=1}^{\infty} n F_{nC} c_n(x) c_n(y) c_n(z) e_{nC}(t) \int_0^t e_{nC}(-\tau) \int_0^{L_x} s_n(u) \int_0^{L_y} c_n(v) \int_0^{L_z} c_n(w) C_{010}(u,v,w,\tau) \frac{C_{000}^{\gamma-1}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)} \times$$

$$\times \frac{2\pi D_{0L}}{L_x L_y L_z^2} \frac{\partial C_{000}(u,v,w,\tau)}{\partial w} d\,w\,d\,v\,d\,u\,d\,\tau - \frac{2\pi D_{0L}}{L_x^2 L_y L_z} \sum_{n=1}^{\infty} n F_{nC} c_n(x) c_n(y) c_n(z)\ e_{nC}(t) \int_0^t e_{nC}(-\tau) \times$$

$$\times \int_0^{L_x} s_n(u) \int_0^{L_y} c_n(v) \int_0^{L_z} c_n(w) \frac{C_{000}^{\gamma}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)} \frac{\partial C_{010}(u,v,w,\tau)}{\partial u} d\,w\,d\,v\,d\,u\,d\,\tau - \frac{2\pi D_{0L}}{L_x L_y^2 L_z} \sum_{n=1}^{\infty} n\ F_{nC} c_n(x) \times$$

$$\times c_n(y) c_n(z) e_{nC}(t) \int_0^t e_{nC}(-\tau) \int_0^{L_x} c_n(u) \int_0^{L_y} s_n(v) \int_0^{L_z} c_n(w) \frac{C_{000}^{\gamma}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)} \frac{\partial C_{010}(u,v,w,\tau)}{\partial v} d\,w\,d\,v\,d\,u\,d\,\tau -$$

$$-\frac{2\pi D_{0L}}{L_x L_y L_z^2} \sum_{n=1}^{\infty} n F_{nC} \int_0^t e_{nC}(-\tau) \int_0^{L_x} c_n(u) \int_0^{L_y} c_n(v) \int_0^{L_z} s_n(w) \frac{C_{000}^{\gamma}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)} \frac{\partial C_{010}(u,v,w,\tau)}{\partial w} d\,w\,d\,v\,d\,u\,d\,\tau \times$$

$$\times c_n(x) c_n(y) c_n(z) e_{nC}(t);$$

$$C_{001}(x,y,z,t) = -\frac{2\pi D_{0L}\Omega}{L_x^2 L_y L_z} \sum_{n=1}^{\infty} n F_{nC} c_n(x) c_n(y) c_n(z) e_{nC}(t) \int_0^t e_{nC}(-\tau) \int_0^{L_x} s_n(u) \int_0^{L_y} \int_0^{L_z} \frac{\nabla_S \mu\ (u,v,w,\tau)}{kT} \times$$

$$\times \left[1 + \varepsilon_{SL} g_{SL}(u,v,w,T)\right] \left[1 + \xi_S \frac{C_{000}^{\gamma}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)}\right] \int_0^{L_z} C_{000}(u,v,W,\tau) d\,W c_n(w) d\,w c_n(v) d\,v\,d\,u\,d\,\tau -$$

$$-\frac{2\pi D_{0L}\Omega}{L_x L_y^2 L_z} \sum_{n=1}^{\infty} n F_{nC} c_n(x) c_n(y) c_n(z) e_{nC}(t) \int_0^t e_{nC}(-\tau) \int_0^{L_x} c_n(u) \int_0^{L_y} s_n(v) \int_0^{L_z} c_n(w) \int_0^{L_z} C_{000}(u,v,W,\tau) d\,W \times$$

$$\times \left[1 + \varepsilon_{SL} g_{SL}\ (u,v,w,T)\right] \left[1 + \xi_S\ \frac{C_{000}^{\gamma}(u,v,w,\tau)}{P^{\gamma}(w,T)}\right] \frac{\nabla_S \mu\ (u,v,w,\tau)}{kT} d\,w\,d\,v\,d\,u\,d\,\tau\,;$$

$$C_{002}(x,y,z,t) = -\frac{2\pi D_{0L}\Omega}{L_x^2 L_y L_z} \sum_{n=1}^{\infty} n F_{nC} c_n(x) c_n(y) c_n(z) e_{nC}(t) \int_0^t e_{nC}(-\tau) \int_0^{L_x} s_n(u) \int_0^{L_y} c_n(v) \int_0^{L_z} \frac{\nabla_S \mu\ (u,v,w,\tau)}{kT} \times$$

$$\times \left[1 + \varepsilon_{SL} g_{SL}(u,v,w,T)\right] \left[1 + \xi_S \frac{C_{000}^{\gamma}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)}\right] \int_0^{L_z} C_{001}(u,v,W,\tau) d\,W c_n(w) d\,w\,d\,v\,d\,u\,d\,\tau - \frac{\pi D_{0L}\Omega}{L_x L_y^2 L_z} \times$$

$$\times\sum_{n=1}^{\infty} n F_{nC} c_n(x) c_n(y) c_n(z) e_{nC}(t) \int_0^t e_{nC}(-\tau) \int_0^{L_x} c_n(u) \int_0^{L_y} s_n(v) \int_0^{L_z} c_n(w) \frac{\nabla_S \mu(u,v,w,\tau)}{kT} \int_0^{L_z} C_{001}(u,v,W,\tau) dW \times$$

$$\times 2\left[1+\varepsilon_{SL} g_{SL}(u,v,w,T)\right]\left[1+\xi_S \frac{C_{000}^{\gamma}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)}\right] d w\, d v\, d u\, d\tau - \frac{2\pi D_{0L}\Omega}{L_x^2 L_y L_z} \sum_{n=1}^{\infty} F_{nC} c_n(x) c_n(y) c_n(z) \times$$

$$\times n e_{nC}(t) \int_0^t e_{nC}(-\tau) \int_0^{L_x} s_n(u) \int_0^{L_y} c_n(v) \int_0^{L_z} c_n(w)\left[1+\xi_S C_{001}^{\gamma}(x,y,z,t) \frac{C_{000}^{\gamma-1}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)}\right] \int_0^{L_z} C_{000}(u,v,W,\tau) dW \times$$

$$\times\left[1+\varepsilon_{SL} g_{SL}(u,v,w,T)\right] \frac{\nabla_S \mu(u,v,w,\tau)}{kT} d w\, d v\, d u\, d\tau - \frac{2\pi D_{0L}\Omega}{L_x L_y^2 L_z} \sum_{n=1}^{\infty} F_{nC} c_n(x) c_n(y) c_n(z) e_{nC}(t) \times$$

$$\times n \int_0^t \int_0^{L_x} s_n(u) \int_0^{L_y} c_n(v) \int_0^{L_z} c_n(w) \frac{\nabla_S \mu(u,v,w,\tau)}{kT}\left[1+\xi_S C_{001}^{\gamma}(x,y,z,t) \frac{C_{000}^{\gamma-1}(u,v,w,\tau)}{P^{\gamma}(w,T)}\right] \int_0^{L_z} C_{000}(u,v,W,\tau) dW \times$$

$$\times\left[1+\varepsilon_{SL} g_{SL}(u,v,w,T)\right] d w\, d v\, d u\, e_{nC}(-\tau) d\tau ;$$

$$C_{110}(x,y,z,t) = -\frac{2\pi D_{0L}}{L_x^2 L_y L_z} \sum_{n=1}^{\infty} n F_{nC} c_n(x) c_n(y) c_n(z) e_{nC}(t) \int_0^t e_{nC}(-\tau) \int_0^{L_x} s_n(u) \int_0^{L_y} c_n(v) \int_0^{L_z} g_L(u,v,w,T) \times$$

$$\times c_n(w) \frac{\partial C_{010}(u,v,w,\tau)}{\partial u} d w\, d v\, d u\, d\tau - \frac{2\pi D_{0L}}{L_x L_y^2 L_z} \sum_{n=1}^{\infty} n F_{nC} c_n(x) c_n(y) c_n(z) e_{nC}(t) \int_0^t e_{nC}(-\tau) \int_0^{L_x} c_n(u) \times$$

$$\times \int_0^{L_y} s_n(v) \int_0^{L_z} c_n(w) g_L(u,v,w,T) \frac{\partial C_{010}(u,v,w,\tau)}{\partial v} d w\, d v\, d u\, d\tau - \frac{2\pi D_{0L}}{L_x L_y L_z^2} \sum_{n=1}^{\infty} n F_{nC} c_n(x) c_n(y) c_n(z) \times$$

$$\times e_{nC}(t) \int_0^t e_{nC}(-\tau) \int_0^{L_x} c_n(u) \int_0^{L_y} c_n(v) \int_0^{L_z} s_n(w)\; g_L(u,v,w,T) \frac{\partial C_{010}(u,v,w,\tau)}{\partial w} d w\, d v\, d u\, d\tau - \frac{2\pi D_{0L}}{L_x^2 L_y L_z} \times$$

$$\times \sum_{n=1}^{\infty} n F_{nC} c_n(x) c_n(y) c_n(z)\, e_{nC}(t) \int_0^t e_{nC}(-\tau) \int_0^{L_x} s_n(u) \int_0^{L_y} c_n(v) \int_0^{L_z} c_n(w) g_L(u,v,w,T) C_{100}(u,v,w,\tau) \times$$

$$\times \frac{C_{000}^{\gamma-1}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)} \frac{\partial C_{000}(u,v,w,\tau)}{\partial u} d w\, d v\, d u\, d\tau - \frac{2\pi D_{0L}}{L_x L_y^2 L_z} \sum_{n=1}^{\infty} n\, F_{nC} c_n(x) c_n(y) c_n(z) e_{nC}(t) \times$$

$$\times \int_0^t e_{nC}(-\tau) \int_0^{L_x} c_n(u) \int_0^{L_y} s_n(v) \int_0^{L_z} g_L(u,v,w,T) C_{100}(u,v,w,\tau) \frac{C_{000}^{\gamma-1}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)} \frac{\partial C_{000}(u,v,w,\tau)}{\partial v} \times$$

$$\times c_n(w)\, d w\, d v\, d u\, d\tau - \frac{2\pi D_{0L}}{L_x L_y L_z^2} \sum_{n=1}^{\infty} n F_{nC} c_n(x) c_n(y) c_n(z)\, e_{nC}(t) \int_0^t e_{nC}(-\tau) \int_0^{L_x} c_n(u) \int_0^{L_y} c_n(v) \times$$

$$\times \int_0^{L_z} s_n(w) g_L(u,v,w,T)\, C_{100}(u,v,w,\tau) \frac{C_{000}^{\gamma-1}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)} \frac{\partial C_{000}(u,v,w,\tau)}{\partial w}\, d w\, d v\, d u\, d\tau -$$

$$-\frac{2\pi D_{0L}}{L_x^2 L_y L_z} \sum_{n=1}^{\infty} n F_{nC} c_n(x) c_n(y) c_n(z) e_{nC}(t) \int_0^t e_{nC}(-\tau) \int_0^{L_x} s_n(u) \int_0^{L_y} c_n(v) \int_0^{L_z} c_n(w)\, g_L(u,v,w,T) \times$$

$$\times \frac{C_{000}^{\gamma}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)} \frac{\partial C_{100}(u,v,w,\tau)}{\partial u} d w\, d v\, d u\, d\tau - \frac{2\pi D_{0L}}{L_x L_y^2 L_z} \sum_{n=1}^{\infty} n c_n(x) c_n(y) c_n(z) e_{nC}(t) \times$$

$$\times F_{nC} \int_0^t e_{nC}(-\tau) \int_0^{L_x} \int_0^{L_y} s_n(v) \int_0^{L_z} c_n(w) g_L(u,v,w,T) \frac{C_{000}^{\gamma}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)} \frac{\partial C_{100}(u,v,w,\tau)}{\partial u} d w\, d v \times$$

$$\times c_n(u) d u\, d\tau - \frac{2\pi D_{0L}}{L_x L_y L_z^2} \sum_{n=1}^{\infty} n F_{nC} c_n(x) c_n(y) c_n(z) e_{nC}(t) \int_0^t e_{nC}(-\tau) \int_0^{L_x} c_n(u) \int_0^{L_y} c_n(v) \int_0^{L_z} s_n(w) \times$$

$$\times g_L(u,v,w,T) \frac{C_{000}^{\gamma}(u,v,w,\tau)}{P^{\gamma}(w,T)} \frac{\partial C_{100}(u,v,w,\tau)}{\partial u} d w\, d v\, d u\, d\tau ;$$

$$C_{101}(x,y,z,t)=-\frac{2\pi D_{0L}}{L_x^2 L_y L_z}\sum_{n=1}^{\infty} n F_{nC} c_n(x) c_n(y) c_n(z) e_{nC}(t)\int_0^t e_{nC}(-\tau)\int_0^{L_x} s_n(u)\int_0^{L_y} c_n(v)\int_0^{L_z} g_L(u,v,w,T)\times$$

$$\times c_n(w)\frac{\partial C_{000}(u,v,w,\tau)}{\partial u}d\,w\,d\,v\,d\,u\,d\,\tau-\frac{2\pi D_{0L}}{L_x L_y^2 L_z}\sum_{n=1}^{\infty} F_{nC} c_n(x) c_n(y) c_n(z)\, e_{nC}(t)\int_0^t e_{nC}(-\tau)\int_0^{L_x} c_n(u)\times$$

$$\times n\int_0^{L_y} s_n(v)\int_0^{L_z} c_n(w)\int_0^{L_z} c_n(w) g_L(u,v,w,T)\frac{\partial C_{000}(u,v,w,\tau)}{\partial v}d\,w\,d\,v\,d\,u\,d\,\tau-\frac{2\pi D_{0L}}{L_x L_y L_z^2}\sum_{n=1}^{\infty} n\, c_n(x) c_n(y)\times$$

$$\times F_{nC} c_n(z) e_{nC}(t)\int_0^t e_{nC}(-\tau)\int_0^{L_x} c_n(u)\int_0^{L_y} c_n(v)\int_0^{L_z} s_n(w) g_L(u,v,w,T)\frac{\partial C_{000}(u,v,w,\tau)}{\partial w}d\,w\,d\,v\,d\,u\,d\,\tau-$$

$$-\Omega\frac{2\pi D_{0L}}{L_x^2 L_y L_z}\sum_{n=1}^{\infty} n F_{nC} c_n(x) c_n(y) c_n(z) e_{nC}(t)\int_0^t e_{nC}(-\tau)\int_0^{L_x} s_n(u)\int_0^{L_y} c_n(v)\int_0^{L_z}\left[1+\varepsilon_{SL} g_{SL}(u,v,w,T)\right]\times$$

$$\times\frac{\nabla_S \mu(u,v,w,\tau)}{kT}\left[1+\xi_S\frac{C_{000}^{\gamma}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)}\right]\int_0^{L_z} C_{100}(u,v,W,\tau)\,dW\,\frac{\nabla_S \mu(u,v,w,\tau)}{kT}d\,w\,d\,v\,d\,u\,d\,\tau-$$

$$-\Omega\frac{2\pi D_{0L}}{L_x^2 L_y L_z}\sum_{n=1}^{\infty} n F_{nC} c_n(x) c_n(y) c_n(z) e_{nC}(t)\int_0^t e_{nC}(-\tau)\int_0^{L_x} s_n(u)\int_0^{L_y} c_n(v)\int_0^{L_z}\left[1+\varepsilon_{SL} g_{SL}(u,v,w,T)\right]\times$$

$$\times c_n(w)\left[1+\xi_S C_{100}(u,v,w,\tau)\frac{C_{000}^{\gamma-1}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)}\right]\frac{\nabla_S \mu(u,v,w,\tau)}{kT}\int_0^{L_z} C_{000}(u,v,W,\tau)\,dW d\,w\,d\,v\,d\,u\,d\,\tau-$$

$$-\Omega\frac{2\pi D_{0L}}{L_x L_y^2 L_z}\sum_{n=1}^{\infty} n F_{nC} c_n(x) c_n(y)\, c_n(z) e_{nC}(t)\int_0^t e_{nC}(-\tau)\int_0^{L_x} c_n(u)\int_0^{L_y} s_n(v)\int_0^{L_z}\left[1+\varepsilon_{SL} g_{SL}(u,v,w,T)\right]\times$$

$$\times c_n(w)\frac{\nabla_S \mu(u,v,w,\tau)}{kT}\left[1+\xi_S C_{100}(u,v,w,\tau)\frac{C_{000}^{\gamma-1}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)}\right]\int_0^{L_z} C_{000}(u,v,W,\tau)\,dW\; d\,w\,d\,v\,d\,u\,d\,\tau;$$

$$C_{011}(x,y,z,t)=-\frac{2\pi D_{0L}}{L_x^2 L_y L_z}\sum_{n=1}^{\infty} n F_{nC} c_n(x) c_n(y) c_n(z) e_{nC}(t)\int_0^t e_{nC}(-\tau)\int_0^{L_x} s_n(u)\int_0^{L_y} c_n(v)\int_0^{L_z}\frac{C_{000}^{\gamma}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)}\times$$

$$\times c_n(w)\frac{\partial C_{001}(u,v,w,\tau)}{\partial u}d\,w\,d\,v\,d\,u\,d\,\tau-\frac{2\pi D_{0L}}{L_x L_y^2 L_z}\sum_{n=1}^{\infty} n F_{nC} c_n(x) c_n(y) c_n(z) e_{nC}(t)\int_0^t e_{nC}(-\tau)\int_0^{L_x} c_n(u)\times$$

$$\times\int_0^{L_y} s_n(v)\int_0^{L_z} c_n(w)\int_0^{L_z} c_n(w)\frac{C_{000}^{\gamma}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)}\frac{\partial C_{001}(u,v,w,\tau)}{\partial v}d\,w\,d\,v\,d\,u\,d\,\tau-\frac{2\pi D_{0L}}{L_x L_y L_z^2}\sum_{n=1}^{\infty} n F_{nC} c_n(x) c_n(y)\times$$

$$\times c_n(z) e_{nC}(t)\int_0^t e_{nC}(-\tau)\int_0^{L_x} c_n(u)\int_0^{L_y} c_n(v)\int_0^{L_z} s_n(w)\frac{C_{000}^{\gamma}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)}\frac{\partial C_{001}(u,v,w,\tau)}{\partial w}d\,w\,d\,v\,d\,u\,d\,\tau-\frac{2\pi D_{0L}}{L_x^2 L_y L_z}\times$$

$$\times\sum_{n=1}^{\infty} F_{nC}\int_0^t e_{nC}(-\tau)\int_0^{L_x} s_n(u)\int_0^{L_y} c_n(v)\int_0^{L_z} c_n(w) C_{001}(u,v,w,\tau)\frac{C_{000}^{\gamma-1}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)}\frac{\partial C_{000}(u,v,w,\tau)}{\partial u}d\,w\,d\,v\,d\,u\,d\,\tau\times$$

$$\times n c_n(x) c_n(y) c_n(z) e_{nC}(t)-\frac{2\pi D_{0L}}{L_x L_y^2 L_z}\sum_{n=1}^{\infty} c_n(x) c_n(y) c_n(z) e_{nC}(t)\int_0^t e_{nC}(-\tau)\int_0^{L_x} c_n(u)\int_0^{L_y} s_n(v)\int_0^{L_z} C_{001}(u,v,w,\tau)\times$$

$$\times n\, F_{nC} c_n(w)\frac{C_{000}^{\gamma-1}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)}\frac{\partial C_{000}(u,v,w,\tau)}{\partial v}d\,w\,d\,v\,d\,u\,d\,\tau-\frac{2\pi D_{0L}}{L_x L_y L_z^2}\sum_{n=1}^{\infty} n\, c_n(x) c_n(y) c_n(z) e_{nC}(t)\times$$

$$\times F_{nC}\int_0^t e_{nC}(-\tau)\int_0^{L_x} c_n(u)\int_0^{L_y} c_n(v)\int_0^{L_z} s_n(w) C_{001}(u,v,w,\tau)\frac{C_{000}^{\gamma-1}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)}\frac{\partial C_{000}(u,v,w,\tau)}{\partial w}d\,w\,d\,v\,d\,u\,d\,\tau-$$

$$-\Omega\frac{2\pi D_{0L}}{L_x^2 L_y L_z}\sum_{n=1}^{\infty} n F_{nC} c_n(x) c_n(y) c_n(z) e_{nC}(t)\int_0^t e_{nC}(-\tau)\int_0^{L_x} s_n(u)\int_0^{L_y} c_n(v)\int_0^{L_z} c_n(w)\left[1+\varepsilon_{SL} g_{SL}(u,v,w,T)\right]\times$$

$$\times\left[1+\xi_S\frac{C_{000}^{\gamma}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)}\right]\frac{\nabla_S\mu\,(u,v,w,\tau)}{kT}\int_0^{L_z}C_{010}(u,v,W,\tau)\,dW\,dw\,dv\,du\,d\tau-\Omega\frac{2\pi D_{0L}}{L_xL_y^2L_z}\sum_{n=1}^{\infty}F_{nC}\times$$

$$\times n\,c_n(x)c_n(y)c_n(z)e_{nC}(t)\int_0^t e_{nC}(-\tau)\int_0^{L_x}c_n(u)\int_0^{L_y}s_n(v)\int_0^{L_z}\left[1+\varepsilon_{SL}g_{SL}(u,v,w,T)\right]\left[1+\xi_S\frac{C_{000}^{\gamma}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)}\right]\times$$

$$\times c_n(w)\frac{\nabla_S\mu\,(u,v,w,\tau)}{kT}\int_0^{L_z}C_{010}(u,v,W,\tau)\,dW\,dw\,dv\,du\,d\tau-\Omega\frac{2\pi D_{0L}}{L_x^2L_yL_z}\sum_{n=1}^{\infty}F_{nC}c_n(x)c_n(y)c_n(z)\times$$

$$\times n\,e_{nC}(t)\int_0^t e_{nC}(-\tau)\int_0^{L_x}s_n(u)\int_0^{L_y}c_n(v)\int_0^{L_z}c_n(w)\left[1+\varepsilon_{SL}g_{SL}(w,T)\right]\left[1+\xi_S C_{010}(u,v,w,\tau)\frac{C_{000}^{\gamma-1}(u,v,w,\tau)}{P^{\gamma}(u,v,w,T)}\right]\times$$

$$\times\frac{\nabla_S\mu\,(u,v,w,\tau)}{kT}\int_0^{L_z}C_{000}(u,v,W,\tau)\,dW\,dw\,dv\,du\,d\tau-\Omega\frac{2\pi D_{0L}}{L_xL_y^2L_z}\sum_{n=1}^{\infty}n\,c_n(x)c_n(y)\,c_n(z)\,e_{nC}(t)\times$$

$$\times F_{nC}\int_0^t e_{nC}(-\tau)\int_0^{L_x}c_n(u)\int_0^{L_y}s_n(v)\int_0^{L_z}c_n(w)\left[1+\varepsilon_{SL}g_{SL}(u,v,w,T)\right]\int_0^{L_z}C_{000}(u,v,W,\tau)\,dW\times$$

$$\times\left[1+\xi_S C_{010}(u,v,w,\tau)\frac{C_{000}^{\gamma-1}(u,v,w,\tau)}{P^{\gamma}(w,T)}\right]\frac{\nabla_S\mu\,(u,v,w,\tau)}{kT}\,dw\,dv\,du\,d\tau\,.$$

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