Аппроксимация функции распределения :имеет вид

$$f = \begin{cases} f_1 = \dfrac{n_1}{(2\pi RT_1)^{3/2}} \exp\left(-\dfrac{(\xi_x - u_1)^2 + \xi_y^2 + \xi_z^2}{2RT_1}\right) & \xi_x \\ f_2 = \dfrac{n_2}{(2\pi RT_2)^{3/2}} \exp\left(-\dfrac{(\xi_x - u_2)^2 + \xi_y^2 + \xi_z^2}{2RT_2}\right) & \xi_x \end{cases}$$

Ищем плотность потока массы

$$\int_{-\infty}^{+\infty} \xi_x f \cdot d\boldsymbol{\xi} = \int_{-\infty}^{+\infty} \xi_x (f_1 + f_2) d\boldsymbol{\xi} = \int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty}\int_{-\infty}^{0} \xi_x f_2 \cdot d\xi_x d\xi_{\mathrm{y}} d\xi_{\mathrm{z}} + \int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty}\int_{0}^{+\infty} \xi_x f_1 \cdot d\xi_x d\xi_{\mathrm{y}} d\xi_{\mathrm{z}}$$

$$\int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty}\int_{-\infty}^{0} \xi_x f_2 \, d\xi_x d\xi_y d\xi_z + \int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty}\int_{0}^{+\infty} \xi_x f_1 \, d\xi_x d\xi_y d\xi_z =$$

$$\frac{n_2}{\left(2\pi RT_2\right)^{3/2}} \int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty}\int_{-\infty}^{0} \xi_x \exp\left(-\frac{\left(\xi_x - u_2\right)^2 + \xi_y^2 + \xi_z^2}{2RT_2}\right) d\xi_x d\xi_x d\xi_y d\xi_z +$$

$$+\frac{n_1}{\left(2\pi RT_1\right)^{3/2}} \int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty}\int_{0}^{+\infty} \xi_x \exp\left(-\frac{\left(\xi_x - u_1\right)^2 + \xi_y^2 + \xi_z^2}{2RT_1}\right) d\xi_x d\xi_x d\xi_y d\xi_z =$$

$$=\frac{n_2}{\left(2\pi RT_2\right)^{3/2}} \int_{-\infty}^{+\infty} \exp\left(-\frac{\xi_z^2}{2RT_2}\right) d\xi_z \int_{-\infty}^{+\infty} \exp\left(-\frac{\xi_y^2}{2RT_2}\right) d\xi_y \int_{-\infty}^{0} \xi_x \exp\left(-\frac{\left(\xi_x - u_2\right)^2}{2RT_2}\right) d\xi_x d\xi_x +$$

$$+\frac{n_1}{\left(2\pi RT_1\right)^{3/2}} \int_{-\infty}^{+\infty} \exp\left(-\frac{\xi_z^2}{2RT_2}\right) d\xi_z \int_{-\infty}^{+\infty} \exp\left(-\frac{\xi_y^2}{2RT_2}\right) d\xi_y \int_{0}^{+\infty} \xi_x \exp\left(-\frac{\left(\xi_x - u_1\right)^2}{2RT_1}\right) d\xi_x d\xi_x$$

$$\int_{-\infty}^{0} \xi_x \exp\left(-\frac{(\xi_x-u_2)^2}{2RT_2}\right) d\xi_x = \int_{-\infty}^{0} \exp\left(-\frac{(\xi_x-u_2)^2}{2RT_2}\right)\left[\xi_x-u_2+u_2\right]\cdot d\xi_x =$$

$$= \int_{-\infty}^{0} \exp\left(-\frac{(\xi_x-u_2)^2}{2RT_2}\right)(\xi_x-u_2)\, d(\xi_x-u_2) + u_2\int_{-\infty}^{0} \exp\left(-\frac{(\xi_x-u_2)^2}{2RT_2}\right)\cdot d(\xi_x-u_2) =$$

$$= \int_{-\infty}^{-u_2} \exp\left(-\frac{y^2}{2RT_2}\right) y\,dy + u_2\int_{-\infty}^{-u_2} \exp\left(-\frac{y^2}{2RT_2}\right)\cdot dy =$$

$$= \frac{1}{2}\int_{-\infty}^{-u_2} \exp\left(-\alpha_2 y^2\right) dy^2 + u_2\int_{-\infty}^{-u_2} \exp\left(-\alpha_2 y^2\right)\cdot dy =$$

$$= -\frac{1}{2\alpha_2}\int_{-\infty}^{-u_2} \exp\left(-\alpha_2 y^2\right) d(-\alpha_2 y^2) + u_2\int_{-\infty}^{-u_2} \exp\left(-\alpha_2 y^2\right)\cdot dy =$$

$$= -\frac{1}{2\alpha_2}\int_{-\infty}^{-\alpha_2 u_2^2} \mathrm{e}^{z}\,dz + u_2\int_{-\infty}^{-u_2} \mathrm{e}^{-\alpha_2 y^2}\,dy$$

$$-\frac{1}{2\alpha_2}\int_{-\infty}^{-\alpha_2 u_2^{\,2}} \mathrm{e}^{z}\,dz = -\frac{1}{2\alpha_2}\mathrm{e}^{-\alpha_2 u_2^{\,2}}$$

$$u_2\int_{-\infty}^{-u_2} \mathrm{e}^{-\alpha_2 y^2}\,dy = u_2\int_{-\infty}^{0} \mathrm{e}^{-\alpha_2 y^2}\,dy - u_2\int_{-u_2}^{0} \mathrm{e}^{-\alpha_2 y^2}\,dy = u_2\frac{1}{2}\sqrt{\frac{\pi}{\alpha_2}} - u_2\int_{0}^{+u_2} \mathrm{e}^{-\alpha_2 y^2}\,dy =$$

$$= \frac{u_2}{2}\sqrt{\frac{\pi}{\alpha_2}} - \frac{u_2}{2}\sqrt{\frac{\pi}{\alpha_2}}\mathrm{erf}(u_2\sqrt{\alpha_2}) = \frac{u_2}{2}\sqrt{\frac{\pi}{\alpha_2}}\left(1-\mathrm{erf}(u_2\sqrt{\alpha_2})\right)$$

$$\int_{0}^{+u_2} \mathrm{e}^{-\alpha_2 y^2}\,dy = \frac{1}{2}\sqrt{\frac{\pi}{\alpha_2}}\mathrm{erf}(u_2\sqrt{\alpha_2})$$

$$\int_{-\infty}^{0} \xi_x \exp\left(-\frac{(\xi_x - u_2)^2}{2RT_2}\right) d\xi_x = -\frac{1}{2\alpha_2}\int_{-\infty}^{-\alpha_2 u_2^{\,2}} \mathrm{e}^{z}\,dz + u_2\int_{-\infty}^{-u_2} \mathrm{e}^{-\alpha_2 y^2}\,dy =$$

$$= -\frac{1}{2\alpha_2}\mathrm{e}^{-\alpha_2 u_2^{\,2}} + \frac{u_2}{2}\sqrt{\frac{\pi}{\alpha_2}}\left(1-\mathrm{erf}(u_2\sqrt{\alpha_2})\right) =$$

$$= -RT_2\exp\left(-\frac{u_2^{\,2}}{2RT_2}\right) + \frac{u_2}{2}\sqrt{2\pi RT_2}\left(1-\mathrm{erf}\left(\frac{u_2}{\sqrt{2RT_2}}\right)\right)$$

$$\frac{n_2}{\left(2\pi RT_2\right)^{3/2}}\int_{-\infty}^{+\infty}\int_{-\infty}^{+\infty}\int_{-\infty}^{0}\xi_x\exp\left(-\frac{(\xi_x-u_2)^2+\xi_y^2+\xi_z^2}{2RT_2}\right)d\xi_x\,d\xi_y\,d\xi_z=$$

$$=\frac{n_2}{\left(2\pi RT_2\right)^{3/2}}\int_{-\infty}^{+\infty}\exp\left(-\frac{\xi_z^2}{2RT_2}\right)d\xi_z\int_{-\infty}^{+\infty}\exp\left(-\frac{\xi_y^2}{2RT_2}\right)d\xi_y\int_{-\infty}^{0}\xi_x\exp\left(-\frac{(\xi_x-u_2)^2}{2RT_2}\right)d\xi_x=$$

$$=\frac{n_2}{\left(2\pi RT_2\right)^{3/2}}\sqrt{2\pi RT_2}\cdot\sqrt{2\pi RT_2}\cdot\int_{-\infty}^{0}\exp\left(-\frac{(\xi_x-u_2)^2}{2RT_2}\right)\xi_x d\xi_x=$$

$$=\frac{n_2}{\left(2\pi RT_2\right)^{1/2}}\left(-RT_2\exp\left(-\frac{u_2^{\,2}}{2RT_2}\right)+\frac{u_2}{2}\sqrt{2\pi RT_2}\left(1-\operatorname{erf}\left(\frac{u_2}{\sqrt{2RT_2}}\right)\right)\right)=$$

$$=-\frac{n_2RT_2}{\left(2\pi RT_2\right)^{1/2}}\exp\left(-\frac{u_2^{\,2}}{2RT_2}\right)+\frac{n_2u_2}{2}\left(1-\operatorname{erf}\left(\frac{u_2}{\sqrt{2RT_2}}\right)\right)=$$

$$=-n_2\sqrt{\frac{RT_2}{2\pi}}\exp\left(-\frac{u_2^{\,2}}{2RT_2}\right)+\frac{n_2u_2}{2}\left(1-\operatorname{erf}\left(\frac{u_2}{\sqrt{2RT_2}}\right)\right)$$

$$\frac{n_1}{(2\pi RT_1)^{3/2}}\int\limits_{-\infty}^{+\infty}\int\limits_{-\infty}^{+\infty}\int\limits_{0}^{+\infty}\xi_x\exp\left(-\frac{(\xi_x-u_1)^2+\xi_y^2+\xi_z^2}{2RT_1}\right)d\xi_x d\xi_y d\xi_z =$$

$$= n_1\sqrt{\frac{RT_1}{2\pi}}\exp\left(-\frac{u_1^2}{2RT_1}\right)+\frac{n_1u_1}{2}\left(1+\operatorname{erf}\left(\frac{u_1}{\sqrt{2RT_1}}\right)\right)$$

$$\int\limits_{-u_1}^{+\infty}\mathrm{e}^{-\alpha_1 y^2}dy=\int\limits_{-u_1}^{0}\mathrm{e}^{-\alpha_1 y^2}dy+\int\limits_{0}^{+\infty}\mathrm{e}^{-\alpha_1 y^2}dy=\int\limits_{0}^{+u_1}\mathrm{e}^{-\alpha_1 y^2}dy+\frac{1}{2}\sqrt{\frac{\pi}{\alpha_1}}=$$

$$=\frac{1}{2}\sqrt{\frac{\pi}{\alpha_1}}\operatorname{erf}(u_2\sqrt{\alpha_1})+\frac{1}{2}\sqrt{\frac{\pi}{\alpha_1}}=\frac{1}{2}\sqrt{\frac{\pi}{\alpha_1}}\left(1+\operatorname{erf}(u_1\sqrt{\alpha_1})\right)$$

$$j_x = m\int\limits_{-\infty}^{+\infty}\int\limits_{-\infty}^{+\infty}\int\limits_{-\infty}^{+\infty}\xi_x f\cdot d\xi_x d\xi_y d\xi_z =$$

$$= n_1\sqrt{\frac{RT_1}{2\pi}}\exp\left(-\frac{u_1^2}{2RT_1}\right)-n_2\sqrt{\frac{RT_2}{2\pi}}\exp\left(-\frac{u_2^2}{2RT_2}\right)+$$

$$+\frac{n_1u_1}{2}\left(1+\operatorname{erf}\left(\frac{u_1}{\sqrt{2RT_1}}\right)\right)+\frac{n_2u_2}{2}\left(1-\operatorname{erf}\left(\frac{u_2}{\sqrt{2RT_2}}\right)\right)$$

$$u_2 = 0$$

$$j_x / m = n_1 \sqrt{\frac{RT_1}{2\pi}} \exp\left(-\frac{}{2} \frac{{u_1}^2}{RT_1} \right) - n_2 \sqrt{\frac{RT_2}{2\pi}} + \frac{n_1 u_1}{2} \left(1 + \operatorname{erf}\left(\frac{u_1}{\sqrt{2RT_1}} \right) \right)$$