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> #Source term Q for the 3D Euler equations -
> # Energy e
>
> Q_e := - $\frac{1}{L(\gamma-1)} \left( \gamma p_x \sin\left(\frac{a_{px}\pi x}{L}\right) \left( u_0 + u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) \right. \right.$ 
  <math>\left. + u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) + u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \right) a_{px}\pi \right)
  <math> + \frac{1}{L(\gamma-1)} \left( \gamma p_y \cos\left(\frac{a_{py}\pi y}{L}\right) \left( v_0 + v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) \right. \right.
  <math>\left. + v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) + v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) \right) a_{py}\pi \right)
  <math> - \frac{1}{L(\gamma-1)} \left( \gamma p_z \sin\left(\frac{a_{pz}\pi z}{L}\right) \left( w_0 + w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) \right. \right.
  <math>\left. + w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) + w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) \right) a_{pz}\pi \right)
  <math> + \frac{1}{2} \frac{1}{L} \left( \cos\left(\frac{a_{rhox}\pi x}{L}\right) rho_x \left( u_0 + u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) \right. \right.
  <math>\left. + u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) + u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \right) \left( u_0^2 + v_0^2 + w_0^2 \right. \right.
  <math>\left. + 2 u_0 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) + 2 u_0 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) \right. \right.
  <math>\left. + 2 u_0 u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) + 2 v_0 v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) \right. \right.
  <math>\left. + 2 v_0 v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) + 2 v_0 v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_0 \right. \right.
  <math>\left. + 2 w_0 w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) w_0 + 2 w_0 w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) \right. \right.
  <math>\left. + 2 w_0 w_z \sin\left(\frac{a_{wz}\pi z}{L}\right) \right) + u_x^2 \sin^2\left(\frac{a_{ux}\pi x}{L}\right) + u_y^2 \cos^2\left(\frac{a_{uy}\pi y}{L}\right) \right. \right.
  <math> + u_z^2 \cos^2\left(\frac{a_{uz}\pi z}{L}\right) + v_x^2 \sin^2\left(\frac{a_{vx}\pi x}{L}\right) + v_y^2 \cos^2\left(\frac{a_{vy}\pi y}{L}\right) \right. \right.
  <math> + v_z^2 \sin^2\left(\frac{a_{vz}\pi z}{L}\right) + w_x^2 \cos^2\left(\frac{a_{wx}\pi x}{L}\right) + w_y^2 \sin^2\left(\frac{a_{wy}\pi y}{L}\right) \right. \right.
  <math> + w_z^2 \cos^2\left(\frac{a_{wz}\pi z}{L}\right) + 2 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) \right. \right.
  <math> + 2 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \right. \right.
  <math> + 2 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \right. \right.

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$$\begin{aligned}
& + 2 v_z \sin\left(\frac{a_vz\pi z}{L}\right) v_x \cos\left(\frac{a_vx\pi x}{L}\right) \\
& + 2 v_z \sin\left(\frac{a_vz\pi z}{L}\right) v_y \sin\left(\frac{a_vy\pi y}{L}\right) \\
& + 2 v_x \cos\left(\frac{a_vx\pi x}{L}\right) v_y \sin\left(\frac{a_vy\pi y}{L}\right) \\
& + 2 w_z \cos\left(\frac{a_wz\pi z}{L}\right) w_x \sin\left(\frac{a_wx\pi x}{L}\right) \\
& + 2 w_z \cos\left(\frac{a_wz\pi z}{L}\right) w_y \sin\left(\frac{a_wy\pi y}{L}\right) \\
& + 2 w_x \sin\left(\frac{a_wx\pi x}{L}\right) w_y \sin\left(\frac{a_wy\pi y}{L}\right) a_rho x \pi \Big) - \frac{1}{2} \frac{1}{L} \left(\left(v_0 \right. \right. \\
& \left. \left. + v_x \cos\left(\frac{a_vx\pi x}{L}\right) + v_y \sin\left(\frac{a_vy\pi y}{L}\right) + v_z \sin\left(\frac{a_vz\pi z}{L}\right) \right) \right. \\
& \left. \left. \sin\left(\frac{a_rho y \pi y}{L}\right) rho_y \left(u_0^2 + v_0^2 + w_0^2 + 2 u_0 u_x \sin\left(\frac{a_ux\pi x}{L}\right) \right. \right. \\
& \left. \left. + 2 u_0 u_y \cos\left(\frac{a_uy\pi y}{L}\right) + 2 u_0 u_z \cos\left(\frac{a_uz\pi z}{L}\right) \right. \right. \\
& \left. \left. + 2 v_0 v_x \cos\left(\frac{a_vx\pi x}{L}\right) + 2 v_0 v_y \sin\left(\frac{a_vy\pi y}{L}\right) \right. \right. \\
& \left. \left. + 2 v_z \sin\left(\frac{a_vz\pi z}{L}\right) v_0 + 2 w_z \cos\left(\frac{a_wz\pi z}{L}\right) w_0 \right. \right. \\
& \left. \left. + 2 w_0 w_x \sin\left(\frac{a_wx\pi x}{L}\right) + 2 w_0 w_y \sin\left(\frac{a_wy\pi y}{L}\right) \right. \right. \\
& \left. \left. + u_x^2 \sin\left(\frac{a_ux\pi x}{L}\right)^2 + u_y^2 \cos\left(\frac{a_uy\pi y}{L}\right)^2 + u_z^2 \cos\left(\frac{a_uz\pi z}{L}\right)^2 \right. \right. \\
& \left. \left. + v_z^2 \sin\left(\frac{a_vz\pi z}{L}\right)^2 + v_x^2 \cos\left(\frac{a_vx\pi x}{L}\right)^2 + v_y^2 \sin\left(\frac{a_vy\pi y}{L}\right)^2 \right. \right. \\
& \left. \left. + w_z^2 \cos\left(\frac{a_wz\pi z}{L}\right)^2 + w_x^2 \sin\left(\frac{a_wx\pi x}{L}\right)^2 + w_y^2 \sin\left(\frac{a_wy\pi y}{L}\right)^2 \right. \right. \\
& \left. \left. + 2 u_x \sin\left(\frac{a_ux\pi x}{L}\right) u_y \cos\left(\frac{a_uy\pi y}{L}\right) \right. \right. \\
& \left. \left. + 2 u_x \sin\left(\frac{a_ux\pi x}{L}\right) u_z \cos\left(\frac{a_uz\pi z}{L}\right) \right. \right. \\
& \left. \left. + 2 u_y \cos\left(\frac{a_uy\pi y}{L}\right) u_z \cos\left(\frac{a_uz\pi z}{L}\right) \right. \right. \\
& \left. \left. + 2 v_z \sin\left(\frac{a_vz\pi z}{L}\right) v_x \cos\left(\frac{a_vx\pi x}{L}\right) \right. \right. \\
& \left. \left. + 2 v_z \sin\left(\frac{a_vz\pi z}{L}\right) v_y \sin\left(\frac{a_vy\pi y}{L}\right) \right. \right.
\end{aligned}$$

$$\begin{aligned}
& + 2 v_x \cos\left(\frac{a_vx\pi x}{L}\right) v_y \sin\left(\frac{a_vy\pi y}{L}\right) \\
& + 2 w_z \cos\left(\frac{a_wz\pi z}{L}\right) w_x \sin\left(\frac{a_wx\pi x}{L}\right) \\
& + 2 w_z \cos\left(\frac{a_wz\pi z}{L}\right) w_y \sin\left(\frac{a_wy\pi y}{L}\right) \\
& + 2 w_x \sin\left(\frac{a_wx\pi x}{L}\right) w_y \sin\left(\frac{a_wy\pi y}{L}\right) a_rho y \pi \Big) + \frac{1}{2} \frac{1}{L} \left(\left(w_0 \right. \right. \\
& \left. \left. + w_x \sin\left(\frac{a_wx\pi x}{L}\right) + w_y \sin\left(\frac{a_wy\pi y}{L}\right) + w_z \cos\left(\frac{a_wz\pi z}{L}\right) \right) \right. \\
& \left. \left. \cos\left(\frac{a_rho z \pi z}{L}\right) rho_z \left(u_0^2 + v_0^2 + w_0^2 + 2 u_0 u_x \sin\left(\frac{a_ux\pi x}{L}\right) \right. \right. \\
& \left. \left. + 2 u_0 u_y \cos\left(\frac{a_uy\pi y}{L}\right) + 2 u_0 u_z \cos\left(\frac{a_uz\pi z}{L}\right) \right. \right. \\
& \left. \left. + 2 v_0 v_x \cos\left(\frac{a_vx\pi x}{L}\right) + 2 v_0 v_y \sin\left(\frac{a_vy\pi y}{L}\right) \right. \right. \\
& \left. \left. + 2 v_z \sin\left(\frac{a_vz\pi z}{L}\right) v_0 + 2 w_z \cos\left(\frac{a_wz\pi z}{L}\right) w_0 \right. \right. \\
& \left. \left. + 2 w_0 w_x \sin\left(\frac{a_wx\pi x}{L}\right) + 2 w_0 w_y \sin\left(\frac{a_wy\pi y}{L}\right) \right. \right. \\
& \left. \left. + u_x^2 \sin\left(\frac{a_ux\pi x}{L}\right)^2 + u_y^2 \cos\left(\frac{a_uy\pi y}{L}\right)^2 + u_z^2 \cos\left(\frac{a_uz\pi z}{L}\right)^2 \right. \right. \\
& \left. \left. + v_z^2 \sin\left(\frac{a_vz\pi z}{L}\right)^2 + v_x^2 \cos\left(\frac{a_vx\pi x}{L}\right)^2 + v_y^2 \sin\left(\frac{a_vy\pi y}{L}\right)^2 \right. \right. \\
& \left. \left. + w_z^2 \cos\left(\frac{a_wz\pi z}{L}\right)^2 + w_x^2 \sin\left(\frac{a_wx\pi x}{L}\right)^2 + w_y^2 \sin\left(\frac{a_wy\pi y}{L}\right)^2 \right. \right. \\
& \left. \left. + 2 u_x \sin\left(\frac{a_ux\pi x}{L}\right) u_y \cos\left(\frac{a_uy\pi y}{L}\right) \right. \right. \\
& \left. \left. + 2 u_x \sin\left(\frac{a_ux\pi x}{L}\right) u_z \cos\left(\frac{a_uz\pi z}{L}\right) \right. \right. \\
& \left. \left. + 2 u_y \cos\left(\frac{a_uy\pi y}{L}\right) u_z \cos\left(\frac{a_uz\pi z}{L}\right) \right. \right. \\
& \left. \left. + 2 v_z \sin\left(\frac{a_vz\pi z}{L}\right) v_x \cos\left(\frac{a_vx\pi x}{L}\right) \right. \right. \\
& \left. \left. + 2 v_z \sin\left(\frac{a_vz\pi z}{L}\right) v_y \sin\left(\frac{a_vy\pi y}{L}\right) \right. \right. \\
& \left. \left. + 2 v_x \cos\left(\frac{a_vx\pi x}{L}\right) v_y \sin\left(\frac{a_vy\pi y}{L}\right) \right. \right. \\
& \left. \left. + 2 w_z \cos\left(\frac{a_wz\pi z}{L}\right) w_x \sin\left(\frac{a_wx\pi x}{L}\right) \right. \right.
\end{aligned}$$

$$\begin{aligned}
& + 2 w_z \cos\left(\frac{a_w z \pi z}{L}\right) w_y \sin\left(\frac{a_w y \pi y}{L}\right) \\
& + 2 w_x \sin\left(\frac{a_w x \pi x}{L}\right) w_y \sin\left(\frac{a_w y \pi y}{L}\right) a_rho z \pi + \frac{1}{2} \frac{1}{L(\gamma-1)} \left(\left(\right. \right. \\
& - 3 u_\theta^2 rho_z \sin\left(\frac{a_rho z \pi z}{L}\right) - 3 u_\theta^2 rho_0 - v_\theta^2 rho_0 - w_\theta^2 rho_0 \\
& - 6 u_0 u_x \sin\left(\frac{a_u x \pi x}{L}\right) rho_0 - 6 u_0 u_y \cos\left(\frac{a_u y \pi y}{L}\right) rho_0 \\
& - 6 u_0 u_z \cos\left(\frac{a_u z \pi z}{L}\right) rho_0 \\
& - 3 u_x^2 \sin\left(\frac{a_u x \pi x}{L}\right)^2 rho_z \sin\left(\frac{a_rho z \pi z}{L}\right) \\
& - 3 u_x^2 \sin\left(\frac{a_u x \pi x}{L}\right)^2 rho_x \sin\left(\frac{a_rho x \pi x}{L}\right) \\
& - 3 u_x^2 \sin\left(\frac{a_u x \pi x}{L}\right)^2 rho_y \cos\left(\frac{a_rho y \pi y}{L}\right) \\
& - 3 u_y^2 \cos\left(\frac{a_u y \pi y}{L}\right)^2 rho_z \sin\left(\frac{a_rho z \pi z}{L}\right) \\
& - 3 u_y^2 \cos\left(\frac{a_u y \pi y}{L}\right)^2 rho_x \sin\left(\frac{a_rho x \pi x}{L}\right) \\
& - 3 u_y^2 \cos\left(\frac{a_u y \pi y}{L}\right)^2 rho_y \cos\left(\frac{a_rho y \pi y}{L}\right) \\
& - 3 u_z^2 \cos\left(\frac{a_u z \pi z}{L}\right)^2 rho_z \sin\left(\frac{a_rho z \pi z}{L}\right) \\
& - 3 u_z^2 \cos\left(\frac{a_u z \pi z}{L}\right)^2 rho_x \sin\left(\frac{a_rho x \pi x}{L}\right) \\
& - 3 u_z^2 \cos\left(\frac{a_u z \pi z}{L}\right)^2 rho_y \cos\left(\frac{a_rho y \pi y}{L}\right) \\
& + 3 u_\theta^2 \gamma rho_z \sin\left(\frac{a_rho z \pi z}{L}\right) + 3 u_\theta^2 \gamma rho_x \sin\left(\frac{a_rho x \pi x}{L}\right) \\
& + 3 u_\theta^2 \gamma rho_y \cos\left(\frac{a_rho y \pi y}{L}\right) + 3 u_x^2 \sin\left(\frac{a_u x \pi x}{L}\right)^2 \gamma rho_0 \\
& + 3 u_y^2 \cos\left(\frac{a_u y \pi y}{L}\right)^2 \gamma rho_0 + 3 u_z^2 \cos\left(\frac{a_u z \pi z}{L}\right)^2 \gamma rho_0 \\
& + \gamma v_\theta^2 rho_z \sin\left(\frac{a_rho z \pi z}{L}\right) + \gamma v_\theta^2 rho_x \sin\left(\frac{a_rho x \pi x}{L}\right) \\
& + \gamma v_\theta^2 rho_y \cos\left(\frac{a_rho y \pi y}{L}\right) - 2 v_0 v_x \cos\left(\frac{a_v x \pi x}{L}\right) rho_0 \\
& - 2 v_0 v_y \sin\left(\frac{a_v y \pi y}{L}\right) rho_0 - 2 v_z \sin\left(\frac{a_v z \pi z}{L}\right) v_0 rho_0
\end{aligned}$$

$$\begin{aligned}
& + \gamma w_0^2 rho_z \sin\left(\frac{a_rhoz\pi z}{L}\right) + \gamma w_0^2 rho_x \sin\left(\frac{a_rhox\pi x}{L}\right) \\
& + \gamma w_0^2 rho_y \cos\left(\frac{a_rhooy\pi y}{L}\right) - 2 w_z \cos\left(\frac{a_wz\pi z}{L}\right) w_0 rho_0 \\
& - 2 w_0 w_x \sin\left(\frac{a_wx\pi x}{L}\right) rho_0 - 2 w_0 w_y \sin\left(\frac{a_wy\pi y}{L}\right) rho_0 \\
& - v_z^2 \sin\left(\frac{a_vz\pi z}{L}\right)^2 rho_z \sin\left(\frac{a_rhoz\pi z}{L}\right) \\
& - v_z^2 \sin\left(\frac{a_vz\pi z}{L}\right)^2 rho_x \sin\left(\frac{a_rhox\pi x}{L}\right) \\
& - v_z^2 \sin\left(\frac{a_vz\pi z}{L}\right)^2 rho_y \cos\left(\frac{a_rhooy\pi y}{L}\right) \\
& - v_x^2 \cos\left(\frac{a_vx\pi x}{L}\right)^2 rho_z \sin\left(\frac{a_rhoz\pi z}{L}\right) \\
& - v_x^2 \cos\left(\frac{a_vx\pi x}{L}\right)^2 rho_x \sin\left(\frac{a_rhox\pi x}{L}\right) \\
& - v_x^2 \cos\left(\frac{a_vx\pi x}{L}\right)^2 rho_y \cos\left(\frac{a_rhooy\pi y}{L}\right) \\
& - v_y^2 \sin\left(\frac{a_vy\pi y}{L}\right)^2 rho_z \sin\left(\frac{a_rhoz\pi z}{L}\right) \\
& - v_y^2 \sin\left(\frac{a_vy\pi y}{L}\right)^2 rho_x \sin\left(\frac{a_rhox\pi x}{L}\right) \\
& - v_y^2 \sin\left(\frac{a_vy\pi y}{L}\right)^2 rho_y \cos\left(\frac{a_rhooy\pi y}{L}\right) \\
& - w_z^2 \cos\left(\frac{a_wz\pi z}{L}\right)^2 rho_z \sin\left(\frac{a_rhoz\pi z}{L}\right) \\
& - w_z^2 \cos\left(\frac{a_wz\pi z}{L}\right)^2 rho_x \sin\left(\frac{a_rhox\pi x}{L}\right) \\
& - w_z^2 \cos\left(\frac{a_wz\pi z}{L}\right)^2 rho_y \cos\left(\frac{a_rhooy\pi y}{L}\right) \\
& - w_x^2 \sin\left(\frac{a_wx\pi x}{L}\right)^2 rho_z \sin\left(\frac{a_rhoz\pi z}{L}\right) \\
& - w_x^2 \sin\left(\frac{a_wx\pi x}{L}\right)^2 rho_x \sin\left(\frac{a_rhox\pi x}{L}\right) \\
& - w_x^2 \sin\left(\frac{a_wx\pi x}{L}\right)^2 rho_y \cos\left(\frac{a_rhooy\pi y}{L}\right) \\
& - w_y^2 \sin\left(\frac{a_wy\pi y}{L}\right)^2 rho_z \sin\left(\frac{a_rhoz\pi z}{L}\right) \\
& - w_y^2 \sin\left(\frac{a_wy\pi y}{L}\right)^2 rho_x \sin\left(\frac{a_rhox\pi x}{L}\right)
\end{aligned}$$

$$\begin{aligned}
& -w_y^2 \sin\left(\frac{a_wy\pi y}{L}\right)^2 rho_y \cos\left(\frac{a_rho y\pi y}{L}\right) \\
& + \gamma v_z^2 \sin\left(\frac{a_vz\pi z}{L}\right)^2 rho_0 + \gamma v_x^2 \cos\left(\frac{a_vx\pi x}{L}\right)^2 rho_0 \\
& + \gamma v_y^2 \sin\left(\frac{a_vy\pi y}{L}\right)^2 rho_0 + \gamma w_z^2 \cos\left(\frac{a_wz\pi z}{L}\right)^2 rho_0 \\
& + \gamma w_x^2 \sin\left(\frac{a_wx\pi x}{L}\right)^2 rho_0 + \gamma w_y^2 \sin\left(\frac{a_wy\pi y}{L}\right)^2 rho_0 \\
& + 2 \gamma w_0 w_y \sin\left(\frac{a_wy\pi y}{L}\right) rho_y \cos\left(\frac{a_rho y\pi y}{L}\right) \\
& - 6 u_x \sin\left(\frac{a_ux\pi x}{L}\right) u_y \cos\left(\frac{a_uy\pi y}{L}\right) rho_x \sin\left(\frac{a_rho x\pi x}{L}\right) \\
& - 6 u_x \sin\left(\frac{a_ux\pi x}{L}\right) u_y \cos\left(\frac{a_uy\pi y}{L}\right) rho_y \cos\left(\frac{a_rho y\pi y}{L}\right) \\
& - 6 u_x \sin\left(\frac{a_ux\pi x}{L}\right) u_z \cos\left(\frac{a_uz\pi z}{L}\right) rho_z \sin\left(\frac{a_rho z\pi z}{L}\right) \\
& - 6 u_x \sin\left(\frac{a_ux\pi x}{L}\right) u_z \cos\left(\frac{a_uz\pi z}{L}\right) rho_x \sin\left(\frac{a_rho x\pi x}{L}\right) \\
& - 6 u_x \sin\left(\frac{a_ux\pi x}{L}\right) u_z \cos\left(\frac{a_uz\pi z}{L}\right) rho_y \cos\left(\frac{a_rho y\pi y}{L}\right) \\
& - 6 u_y \cos\left(\frac{a_uy\pi y}{L}\right) u_z \cos\left(\frac{a_uz\pi z}{L}\right) rho_z \sin\left(\frac{a_rho z\pi z}{L}\right) \\
& - 6 u_y \cos\left(\frac{a_uy\pi y}{L}\right) u_z \cos\left(\frac{a_uz\pi z}{L}\right) rho_x \sin\left(\frac{a_rho x\pi x}{L}\right) \\
& - 6 u_y \cos\left(\frac{a_uy\pi y}{L}\right) u_z \cos\left(\frac{a_uz\pi z}{L}\right) rho_y \cos\left(\frac{a_rho y\pi y}{L}\right) \\
& + 6 u_0 u_x \sin\left(\frac{a_ux\pi x}{L}\right) \gamma rho_z \sin\left(\frac{a_rho z\pi z}{L}\right) \\
& + 6 u_0 u_x \sin\left(\frac{a_ux\pi x}{L}\right) \gamma rho_x \sin\left(\frac{a_rho x\pi x}{L}\right) \\
& + 6 u_0 u_x \sin\left(\frac{a_ux\pi x}{L}\right) \gamma rho_y \cos\left(\frac{a_rho y\pi y}{L}\right) \\
& + 6 u_0 u_y \cos\left(\frac{a_uy\pi y}{L}\right) \gamma rho_z \sin\left(\frac{a_rho z\pi z}{L}\right) \\
& + 6 u_0 u_y \cos\left(\frac{a_uy\pi y}{L}\right) \gamma rho_x \sin\left(\frac{a_rho x\pi x}{L}\right) \\
& + 6 u_0 u_y \cos\left(\frac{a_uy\pi y}{L}\right) \gamma rho_y \cos\left(\frac{a_rho y\pi y}{L}\right) \\
& + 6 u_0 u_z \cos\left(\frac{a_uz\pi z}{L}\right) \gamma rho_z \sin\left(\frac{a_rho z\pi z}{L}\right)
\end{aligned}$$

$$\begin{aligned}
& + 6 u_0 u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \gamma rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + 6 u_0 u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \gamma rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& + 6 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) \gamma rho_0 \\
& + 6 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \gamma rho_0 \\
& + 6 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \gamma rho_0 \\
& + 2 \gamma v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) rho_0 \\
& + 2 \gamma v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_0 \\
& + 2 \gamma v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_0 \\
& + 2 \gamma w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) rho_0 \\
& + 2 \gamma w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_0 \\
& + 2 \gamma w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_0 \\
& + 2 \gamma v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_0 rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& + 2 \gamma v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_0 rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + 2 \gamma v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_0 rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& + 2 \gamma v_0 v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& + 2 \gamma v_0 v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + 2 \gamma v_0 v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& + 2 \gamma v_0 v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& + 2 \gamma v_0 v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + 2 \gamma v_0 v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right)
\end{aligned}$$

$$\begin{aligned}
& + 2 \gamma w_z \cos\left(\frac{a_w z \pi z}{L}\right) w_0 \rho_y \cos\left(\frac{a_r h o y \pi y}{L}\right) \\
& + 2 \gamma w_0 w_x \sin\left(\frac{a_w x \pi x}{L}\right) \rho_z \sin\left(\frac{a_r h o z \pi z}{L}\right) \\
& + 2 \gamma w_0 w_x \sin\left(\frac{a_w x \pi x}{L}\right) \rho_x \sin\left(\frac{a_r h o x \pi x}{L}\right) \\
& + 2 \gamma w_0 w_x \sin\left(\frac{a_w x \pi x}{L}\right) \rho_y \cos\left(\frac{a_r h o y \pi y}{L}\right) \\
& + 2 \gamma w_0 w_y \sin\left(\frac{a_w y \pi y}{L}\right) \rho_z \sin\left(\frac{a_r h o z \pi z}{L}\right) \\
& + 2 \gamma w_0 w_y \sin\left(\frac{a_w y \pi y}{L}\right) \rho_x \sin\left(\frac{a_r h o x \pi x}{L}\right) \\
& - 6 u_x \sin\left(\frac{a_u x \pi x}{L}\right) u_y \cos\left(\frac{a_u y \pi y}{L}\right) \rho_0 \\
& - 6 u_x \sin\left(\frac{a_u x \pi x}{L}\right) u_z \cos\left(\frac{a_u z \pi z}{L}\right) \rho_0 \\
& - 6 u_y \cos\left(\frac{a_u y \pi y}{L}\right) u_z \cos\left(\frac{a_u z \pi z}{L}\right) \rho_0 \\
& + 6 u_0 u_x \sin\left(\frac{a_u x \pi x}{L}\right) \gamma \rho_0 + 6 u_0 u_y \cos\left(\frac{a_u y \pi y}{L}\right) \gamma \rho_0 \\
& + 6 u_0 u_z \cos\left(\frac{a_u z \pi z}{L}\right) \gamma \rho_0 \\
& - 6 u_0 u_x \sin\left(\frac{a_u x \pi x}{L}\right) \rho_z \sin\left(\frac{a_r h o z \pi z}{L}\right) \\
& - 6 u_0 u_x \sin\left(\frac{a_u x \pi x}{L}\right) \rho_x \sin\left(\frac{a_r h o x \pi x}{L}\right) \\
& - 6 u_0 u_x \sin\left(\frac{a_u x \pi x}{L}\right) \rho_y \cos\left(\frac{a_r h o y \pi y}{L}\right) \\
& - 6 u_0 u_y \cos\left(\frac{a_u y \pi y}{L}\right) \rho_z \sin\left(\frac{a_r h o z \pi z}{L}\right) \\
& - 6 u_0 u_y \cos\left(\frac{a_u y \pi y}{L}\right) \rho_x \sin\left(\frac{a_r h o x \pi x}{L}\right) \\
& - 6 u_0 u_y \cos\left(\frac{a_u y \pi y}{L}\right) \rho_y \cos\left(\frac{a_r h o y \pi y}{L}\right) \\
& - 6 u_0 u_z \cos\left(\frac{a_u z \pi z}{L}\right) \rho_z \sin\left(\frac{a_r h o z \pi z}{L}\right) \\
& - 6 u_0 u_z \cos\left(\frac{a_u z \pi z}{L}\right) \rho_x \sin\left(\frac{a_r h o x \pi x}{L}\right) \\
& - 6 u_0 u_z \cos\left(\frac{a_u z \pi z}{L}\right) \rho_y \cos\left(\frac{a_r h o y \pi y}{L}\right)
\end{aligned}$$

$$\begin{aligned}
& + 3 u_x^2 \sin\left(\frac{a_{ux}\pi x}{L}\right)^2 \gamma rho_z \sin\left(\frac{a_rhoz\pi z}{L}\right) \\
& + 3 u_x^2 \sin\left(\frac{a_{ux}\pi x}{L}\right)^2 \gamma rho_x \sin\left(\frac{a_rhox\pi x}{L}\right) \\
& + 3 u_x^2 \sin\left(\frac{a_{ux}\pi x}{L}\right)^2 \gamma rho_y \cos\left(\frac{a_rhoy\pi y}{L}\right) \\
& + 3 u_y^2 \cos\left(\frac{a_{uy}\pi y}{L}\right)^2 \gamma rho_z \sin\left(\frac{a_rhoz\pi z}{L}\right) \\
& + 3 u_y^2 \cos\left(\frac{a_{uy}\pi y}{L}\right)^2 \gamma rho_x \sin\left(\frac{a_rhox\pi x}{L}\right) \\
& + 3 u_y^2 \cos\left(\frac{a_{uy}\pi y}{L}\right)^2 \gamma rho_y \cos\left(\frac{a_rhoy\pi y}{L}\right) \\
& + 3 u_z^2 \cos\left(\frac{a_{uz}\pi z}{L}\right)^2 \gamma rho_z \sin\left(\frac{a_rhoz\pi z}{L}\right) \\
& + 3 u_z^2 \cos\left(\frac{a_{uz}\pi z}{L}\right)^2 \gamma rho_x \sin\left(\frac{a_rhox\pi x}{L}\right) \\
& + 3 u_z^2 \cos\left(\frac{a_{uz}\pi z}{L}\right)^2 \gamma rho_y \cos\left(\frac{a_rhoy\pi y}{L}\right) \\
& - 2 v_0 v_x \cos\left(\frac{a_vx\pi x}{L}\right) rho_z \sin\left(\frac{a_rhoz\pi z}{L}\right) \\
& - 2 v_0 v_x \cos\left(\frac{a_vx\pi x}{L}\right) rho_x \sin\left(\frac{a_rhox\pi x}{L}\right) \\
& - 2 v_0 v_x \cos\left(\frac{a_vx\pi x}{L}\right) rho_y \cos\left(\frac{a_rhoy\pi y}{L}\right) \\
& - 2 v_0 v_y \sin\left(\frac{a_vy\pi y}{L}\right) rho_z \sin\left(\frac{a_rhoz\pi z}{L}\right) \\
& - 2 v_0 v_y \sin\left(\frac{a_vy\pi y}{L}\right) rho_x \sin\left(\frac{a_rhox\pi x}{L}\right) \\
& - 2 v_0 v_y \sin\left(\frac{a_vy\pi y}{L}\right) rho_y \cos\left(\frac{a_rhoy\pi y}{L}\right) \\
& - 2 v_z \sin\left(\frac{a_vz\pi z}{L}\right) v_0 rho_z \sin\left(\frac{a_rhoz\pi z}{L}\right) \\
& - 2 v_z \sin\left(\frac{a_vz\pi z}{L}\right) v_0 rho_x \sin\left(\frac{a_rhox\pi x}{L}\right) \\
& - 2 v_z \sin\left(\frac{a_vz\pi z}{L}\right) v_0 rho_y \cos\left(\frac{a_rhoy\pi y}{L}\right) \\
& - 2 w_z \cos\left(\frac{a_wz\pi z}{L}\right) w_0 rho_z \sin\left(\frac{a_rhoz\pi z}{L}\right) \\
& - 2 w_z \cos\left(\frac{a_wz\pi z}{L}\right) w_0 rho_x \sin\left(\frac{a_rhox\pi x}{L}\right)
\end{aligned}$$

$$\begin{aligned}
& -2 w_z \cos\left(\frac{a_w z \pi z}{L}\right) w_0 \rho_y \cos\left(\frac{a_r h o y \pi y}{L}\right) \\
& -2 w_0 w_x \sin\left(\frac{a_w x \pi x}{L}\right) \rho_z \sin\left(\frac{a_r h o z \pi z}{L}\right) \\
& -2 w_0 w_x \sin\left(\frac{a_w x \pi x}{L}\right) \rho_x \sin\left(\frac{a_r h o x \pi x}{L}\right) \\
& -2 w_0 w_x \sin\left(\frac{a_w x \pi x}{L}\right) \rho_y \cos\left(\frac{a_r h o y \pi y}{L}\right) \\
& -2 w_0 w_y \sin\left(\frac{a_w y \pi y}{L}\right) \rho_z \sin\left(\frac{a_r h o z \pi z}{L}\right) \\
& -2 w_0 w_y \sin\left(\frac{a_w y \pi y}{L}\right) \rho_x \sin\left(\frac{a_r h o x \pi x}{L}\right) \\
& -2 w_0 w_y \sin\left(\frac{a_w y \pi y}{L}\right) \rho_y \cos\left(\frac{a_r h o y \pi y}{L}\right) \\
& + \gamma v_z^2 \sin\left(\frac{a_v z \pi z}{L}\right)^2 \rho_z \sin\left(\frac{a_r h o z \pi z}{L}\right) \\
& + \gamma v_z^2 \sin\left(\frac{a_v z \pi z}{L}\right)^2 \rho_x \sin\left(\frac{a_r h o x \pi x}{L}\right) \\
& + \gamma v_z^2 \sin\left(\frac{a_v z \pi z}{L}\right)^2 \rho_y \cos\left(\frac{a_r h o y \pi y}{L}\right) \\
& + \gamma v_x^2 \cos\left(\frac{a_v x \pi x}{L}\right)^2 \rho_z \sin\left(\frac{a_r h o z \pi z}{L}\right) \\
& + \gamma v_x^2 \cos\left(\frac{a_v x \pi x}{L}\right)^2 \rho_x \sin\left(\frac{a_r h o x \pi x}{L}\right) \\
& + \gamma v_x^2 \cos\left(\frac{a_v x \pi x}{L}\right)^2 \rho_y \cos\left(\frac{a_r h o y \pi y}{L}\right) \\
& + \gamma v_y^2 \sin\left(\frac{a_v y \pi y}{L}\right)^2 \rho_z \sin\left(\frac{a_r h o z \pi z}{L}\right) \\
& + \gamma v_y^2 \sin\left(\frac{a_v y \pi y}{L}\right)^2 \rho_x \sin\left(\frac{a_r h o x \pi x}{L}\right) \\
& + \gamma v_y^2 \sin\left(\frac{a_v y \pi y}{L}\right)^2 \rho_y \cos\left(\frac{a_r h o y \pi y}{L}\right) \\
& + 2 \gamma v_z \sin\left(\frac{a_v z \pi z}{L}\right) v_0 \rho_0 + 2 \gamma v_0 v_x \cos\left(\frac{a_v x \pi x}{L}\right) \rho_0 \\
& + 2 \gamma v_0 v_y \sin\left(\frac{a_v y \pi y}{L}\right) \rho_0 \\
& - 2 v_z \sin\left(\frac{a_v z \pi z}{L}\right) v_x \cos\left(\frac{a_v x \pi x}{L}\right) \rho_0 \\
& - 2 v_z \sin\left(\frac{a_v z \pi z}{L}\right) v_y \sin\left(\frac{a_v y \pi y}{L}\right) \rho_0
\end{aligned}$$

$$\begin{aligned}
& -2 v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_0 \\
& + \gamma w_z^2 \cos\left(\frac{a_{wz}\pi z}{L}\right)^2 rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& + \gamma w_z^2 \cos\left(\frac{a_{wz}\pi z}{L}\right)^2 rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + \gamma w_z^2 \cos\left(\frac{a_{wz}\pi z}{L}\right)^2 rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& + \gamma w_x^2 \sin\left(\frac{a_{wx}\pi x}{L}\right)^2 rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& + \gamma w_x^2 \sin\left(\frac{a_{wx}\pi x}{L}\right)^2 rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + \gamma w_x^2 \sin\left(\frac{a_{wx}\pi x}{L}\right)^2 rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& + \gamma w_y^2 \sin\left(\frac{a_{wy}\pi y}{L}\right)^2 rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& + \gamma w_y^2 \sin\left(\frac{a_{wy}\pi y}{L}\right)^2 rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + \gamma w_y^2 \sin\left(\frac{a_{wy}\pi y}{L}\right)^2 rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& - 2 w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) rho_0 \\
& - 2 w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_0 \\
& - 2 w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_0 \\
& + 2 \gamma w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) w_0 rho_0 + 2 \gamma w_0 w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) rho_0 \\
& + 2 \gamma w_0 w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_0 \\
& + 6 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) \gamma rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& + 6 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) \gamma rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + 6 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) \gamma rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& + 6 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \gamma rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& + 6 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \gamma rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right)
\end{aligned}$$

$$\begin{aligned}
& + 2 \gamma w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + 2 \gamma w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& - 3 u_0^2 rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) - 3 u_0^2 rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& - 3 u_x^2 \sin\left(\frac{a_{ux}\pi x}{L}\right)^2 rho_0 - 3 u_y^2 \cos\left(\frac{a_{uy}\pi y}{L}\right)^2 rho_0 \\
& - 3 u_z^2 \cos\left(\frac{a_{uz}\pi z}{L}\right)^2 rho_0 + 3 u_0^2 \gamma rho_0 \\
& - v_0^2 rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) - v_0^2 rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& - v_0^2 rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) - w_0^2 rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& - w_0^2 rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) - w_0^2 rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) + \gamma v_0^2 rho_0 \\
& + \gamma w_0^2 rho_0 - v_z^2 \sin\left(\frac{a_{vz}\pi z}{L}\right)^2 rho_0 - v_x^2 \cos\left(\frac{a_{vx}\pi x}{L}\right)^2 rho_0 \\
& - v_y^2 \sin\left(\frac{a_{vy}\pi y}{L}\right)^2 rho_0 - w_z^2 \cos\left(\frac{a_{wz}\pi z}{L}\right)^2 rho_0 \\
& - w_x^2 \sin\left(\frac{a_{wx}\pi x}{L}\right)^2 rho_0 - w_y^2 \sin\left(\frac{a_{wy}\pi y}{L}\right)^2 rho_0 \\
& - 6 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) + 2 p_0 \gamma \\
& + 2 p_x \cos\left(\frac{a_{px}\pi x}{L}\right) \gamma + 2 p_y \sin\left(\frac{a_{py}\pi y}{L}\right) \gamma + 2 p_z \cos\left(\frac{a_{pz}\pi z}{L}\right) \gamma \\
& u_x \cos\left(\frac{a_{ux}\pi x}{L}\right) a_{ux}\pi \Big) + \left(\left(v_0 + v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) \right. \right. \\
& \left. \left. + v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) + v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) \right) \left(u_y \sin\left(\frac{a_{uy}\pi y}{L}\right) \right. \right. \\
& \left. \left. + rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) + rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \right. \right. \\
& \left. \left. + rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \right)^2 \left(u_0 + u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) + u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) \right. \right. \\
& \left. \left. + u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \right) - u_y \sin\left(\frac{a_{uy}\pi y}{L}\right) \left(rho_0 \right. \right. \\
& \left. \left. + rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) + rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \right. \right. \\
& \left. \left. + rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \right)^2 \left(u_0 + u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) + u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) \right)
\end{aligned}$$

$$\begin{aligned}
& + u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \left(\rho_0 + \frac{a_{rho_x}\pi x}{L} \sin\left(\frac{a_{rho_x}\pi x}{L}\right) + \frac{a_{rho_y}\pi y}{L} \cos\left(\frac{a_{rho_y}\pi y}{L}\right) \right) \\
& + \frac{a_{rho_z}\pi z}{L} \sin\left(\frac{a_{rho_z}\pi z}{L}\right) \left(w_0 + w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) + w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) + w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) \right) \\
& \left(u_z \sin\left(\frac{a_{uz}\pi z}{L}\right) \left(\rho_0 + \rho_x \sin\left(\frac{a_{rho_x}\pi x}{L}\right) + \rho_y \cos\left(\frac{a_{rho_y}\pi y}{L}\right) + \rho_z \sin\left(\frac{a_{rho_z}\pi z}{L}\right) \right)^2 \right. \\
& \left. \left(u_0 + u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) + u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) + u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \right) \right. \\
& \left. - u_z \sin\left(\frac{a_{uz}\pi z}{L}\right) \left(\rho_0 + \rho_x \sin\left(\frac{a_{rho_x}\pi x}{L}\right) + \rho_y \cos\left(\frac{a_{rho_y}\pi y}{L}\right) + \rho_z \sin\left(\frac{a_{rho_z}\pi z}{L}\right) \right)^2 \right. \\
& \left. \left(u_0 + u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) + u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) + u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \right) \gamma \right) a_{uz}\pi \\
& \left/ \left((\gamma - 1) L \left(\rho_0 + \rho_x \sin\left(\frac{a_{rho_x}\pi x}{L}\right) + \rho_y \cos\left(\frac{a_{rho_y}\pi y}{L}\right) + \rho_z \sin\left(\frac{a_{rho_z}\pi z}{L}\right) \right) \right. \right. \\
& \left. \left. + u_0 + u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) + u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) + u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \right) \right. \\
& \left. + v_x \sin\left(\frac{a_{vx}\pi x}{L}\right) \left(\rho_0 + \rho_x \sin\left(\frac{a_{rho_x}\pi x}{L}\right) + \rho_y \cos\left(\frac{a_{rho_y}\pi y}{L}\right) + \rho_z \sin\left(\frac{a_{rho_z}\pi z}{L}\right) \right)^2 \right. \\
& \left. \left(v_0 + v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) + v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) + v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) \right) - v_x \sin\left(\frac{a_{vx}\pi x}{L}\right) \right. \\
& \left. + v_0 + v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) + v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) + v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) \right) \gamma \right) a_{vx}\pi \\
& \left/ \left((\gamma - 1) L \left(\rho_0 + \rho_x \sin\left(\frac{a_{rho_x}\pi x}{L}\right) + \rho_y \cos\left(\frac{a_{rho_y}\pi y}{L}\right) + \rho_z \sin\left(\frac{a_{rho_z}\pi z}{L}\right) \right) \right. \right. \\
& \left. \left. + v_0 + v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) + v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) + v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) \right) \gamma \right) a_{vy}\pi \\
& \left/ \left((\gamma - 1) L \left(\rho_0 + \rho_x \sin\left(\frac{a_{rho_x}\pi x}{L}\right) + \rho_y \cos\left(\frac{a_{rho_y}\pi y}{L}\right) + \rho_z \sin\left(\frac{a_{rho_z}\pi z}{L}\right) \right) \right. \right. \\
& \left. \left. + v_0 + v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) + v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) + v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) \right) \gamma \right) a_{vz}\pi
\end{aligned}$$

$$\begin{aligned}
& + \text{rho_z} \sin\left(\frac{a_{rhoz}\pi z}{L}\right)\right)\right) + \frac{1}{2} \frac{1}{L(\gamma-1)} \left(\left(\right. \right. \\
& - u_0^2 \text{rho_z} \sin\left(\frac{a_{rhoz}\pi z}{L}\right) - u_0^2 \text{rho_0} - 3 v_0^2 \text{rho_0} - w_0^2 \text{rho_0} \\
& - 2 u_0 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) \text{rho_0} - 2 u_0 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) \text{rho_0} \\
& - 2 u_0 u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \text{rho_0} \\
& - u_x^2 \sin\left(\frac{a_{ux}\pi x}{L}\right)^2 \text{rho_z} \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& - u_x^2 \sin\left(\frac{a_{ux}\pi x}{L}\right)^2 \text{rho_x} \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& - u_x^2 \sin\left(\frac{a_{ux}\pi x}{L}\right)^2 \text{rho_y} \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& - u_y^2 \cos\left(\frac{a_{uy}\pi y}{L}\right)^2 \text{rho_z} \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& - u_y^2 \cos\left(\frac{a_{uy}\pi y}{L}\right)^2 \text{rho_x} \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& - u_y^2 \cos\left(\frac{a_{uy}\pi y}{L}\right)^2 \text{rho_y} \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& - u_z^2 \cos\left(\frac{a_{uz}\pi z}{L}\right)^2 \text{rho_z} \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& - u_z^2 \cos\left(\frac{a_{uz}\pi z}{L}\right)^2 \text{rho_x} \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& - u_z^2 \cos\left(\frac{a_{uz}\pi z}{L}\right)^2 \text{rho_y} \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& + u_0^2 \gamma \text{rho_z} \sin\left(\frac{a_{rhoz}\pi z}{L}\right) + u_0^2 \gamma \text{rho_x} \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + u_0^2 \gamma \text{rho_y} \cos\left(\frac{a_{rhoy}\pi y}{L}\right) + u_x^2 \sin\left(\frac{a_{ux}\pi x}{L}\right)^2 \gamma \text{rho_0} \\
& + u_y^2 \cos\left(\frac{a_{uy}\pi y}{L}\right)^2 \gamma \text{rho_0} + u_z^2 \cos\left(\frac{a_{uz}\pi z}{L}\right)^2 \gamma \text{rho_0} \\
& + 3 \gamma v_0^2 \text{rho_z} \sin\left(\frac{a_{rhoz}\pi z}{L}\right) + 3 \gamma v_0^2 \text{rho_x} \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + 3 \gamma v_0^2 \text{rho_y} \cos\left(\frac{a_{rhoy}\pi y}{L}\right) - 6 v_0 v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) \text{rho_0} \\
& - 6 v_0 v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) \text{rho_0} - 6 v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_0 \text{rho_0} \\
& + \gamma w_0^2 \text{rho_z} \sin\left(\frac{a_{rhoz}\pi z}{L}\right) + \gamma w_0^2 \text{rho_x} \sin\left(\frac{a_{rhox}\pi x}{L}\right)
\end{aligned}$$

$$\begin{aligned}
& + \gamma w_0^2 rho_y \cos\left(\frac{a_rho y \pi y}{L}\right) - 2 w_z \cos\left(\frac{a_w z \pi z}{L}\right) w_0 rho_0 \\
& - 2 w_0 w_x \sin\left(\frac{a_w x \pi x}{L}\right) rho_0 - 2 w_0 w_y \sin\left(\frac{a_w y \pi y}{L}\right) rho_0 \\
& - 3 v_z^2 \sin\left(\frac{a_v z \pi z}{L}\right)^2 rho_z \sin\left(\frac{a_rho z \pi z}{L}\right) \\
& - 3 v_z^2 \sin\left(\frac{a_v z \pi z}{L}\right)^2 rho_x \sin\left(\frac{a_rho x \pi x}{L}\right) \\
& - 3 v_z^2 \sin\left(\frac{a_v z \pi z}{L}\right)^2 rho_y \cos\left(\frac{a_rho y \pi y}{L}\right) \\
& - 3 v_x^2 \cos\left(\frac{a_v x \pi x}{L}\right)^2 rho_z \sin\left(\frac{a_rho z \pi z}{L}\right) \\
& - 3 v_x^2 \cos\left(\frac{a_v x \pi x}{L}\right)^2 rho_x \sin\left(\frac{a_rho x \pi x}{L}\right) \\
& - 3 v_x^2 \cos\left(\frac{a_v x \pi x}{L}\right)^2 rho_y \cos\left(\frac{a_rho y \pi y}{L}\right) \\
& - 3 v_y^2 \sin\left(\frac{a_v y \pi y}{L}\right)^2 rho_z \sin\left(\frac{a_rho z \pi z}{L}\right) \\
& - 3 v_y^2 \sin\left(\frac{a_v y \pi y}{L}\right)^2 rho_x \sin\left(\frac{a_rho x \pi x}{L}\right) \\
& - 3 v_y^2 \sin\left(\frac{a_v y \pi y}{L}\right)^2 rho_y \cos\left(\frac{a_rho y \pi y}{L}\right) \\
& - w_z^2 \cos\left(\frac{a_w z \pi z}{L}\right)^2 rho_z \sin\left(\frac{a_rho z \pi z}{L}\right) \\
& - w_z^2 \cos\left(\frac{a_w z \pi z}{L}\right)^2 rho_x \sin\left(\frac{a_rho x \pi x}{L}\right) \\
& - w_z^2 \cos\left(\frac{a_w z \pi z}{L}\right)^2 rho_y \cos\left(\frac{a_rho y \pi y}{L}\right) \\
& - w_x^2 \sin\left(\frac{a_w x \pi x}{L}\right)^2 rho_z \sin\left(\frac{a_rho z \pi z}{L}\right) \\
& - w_x^2 \sin\left(\frac{a_w x \pi x}{L}\right)^2 rho_x \sin\left(\frac{a_rho x \pi x}{L}\right) \\
& - w_x^2 \sin\left(\frac{a_w x \pi x}{L}\right)^2 rho_y \cos\left(\frac{a_rho y \pi y}{L}\right) \\
& - w_y^2 \sin\left(\frac{a_w y \pi y}{L}\right)^2 rho_z \sin\left(\frac{a_rho z \pi z}{L}\right) \\
& - w_y^2 \sin\left(\frac{a_w y \pi y}{L}\right)^2 rho_x \sin\left(\frac{a_rho x \pi x}{L}\right) \\
& - w_y^2 \sin\left(\frac{a_w y \pi y}{L}\right)^2 rho_y \cos\left(\frac{a_rho y \pi y}{L}\right)
\end{aligned}$$

$$\begin{aligned}
& + 3 \gamma v_z^2 \sin\left(\frac{a_{vz}\pi z}{L}\right)^2 rho_0 + 3 \gamma v_x^2 \cos\left(\frac{a_{vx}\pi x}{L}\right)^2 rho_0 \\
& + 3 \gamma v_y^2 \sin\left(\frac{a_{vy}\pi y}{L}\right)^2 rho_0 + \gamma w_z^2 \cos\left(\frac{a_{wz}\pi z}{L}\right)^2 rho_0 \\
& + \gamma w_x^2 \sin\left(\frac{a_{wx}\pi x}{L}\right)^2 rho_0 + \gamma w_y^2 \sin\left(\frac{a_{wy}\pi y}{L}\right)^2 rho_0 \\
& + 2 \gamma w_0 w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_y \cos\left(\frac{a_{rho_y}\pi y}{L}\right) \\
& - 2 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) rho_x \sin\left(\frac{a_{rho_x}\pi x}{L}\right) \\
& - 2 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) rho_y \cos\left(\frac{a_{rho_y}\pi y}{L}\right) \\
& - 2 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) rho_z \sin\left(\frac{a_{rho_z}\pi z}{L}\right) \\
& - 2 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) rho_x \sin\left(\frac{a_{rho_x}\pi x}{L}\right) \\
& - 2 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) rho_y \cos\left(\frac{a_{rho_y}\pi y}{L}\right) \\
& - 2 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) rho_z \sin\left(\frac{a_{rho_z}\pi z}{L}\right) \\
& - 2 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) rho_x \sin\left(\frac{a_{rho_x}\pi x}{L}\right) \\
& - 2 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) rho_y \cos\left(\frac{a_{rho_y}\pi y}{L}\right) \\
& + 2 u_0 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) \gamma rho_z \sin\left(\frac{a_{rho_z}\pi z}{L}\right) \\
& + 2 u_0 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) \gamma rho_x \sin\left(\frac{a_{rho_x}\pi x}{L}\right) \\
& + 2 u_0 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) \gamma rho_y \cos\left(\frac{a_{rho_y}\pi y}{L}\right) \\
& + 2 u_0 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) \gamma rho_z \sin\left(\frac{a_{rho_z}\pi z}{L}\right) \\
& + 2 u_0 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) \gamma rho_x \sin\left(\frac{a_{rho_x}\pi x}{L}\right) \\
& + 2 u_0 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) \gamma rho_y \cos\left(\frac{a_{rho_y}\pi y}{L}\right) \\
& + 2 u_0 u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \gamma rho_z \sin\left(\frac{a_{rho_z}\pi z}{L}\right) \\
& + 2 u_0 u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \gamma rho_x \sin\left(\frac{a_{rho_x}\pi x}{L}\right)
\end{aligned}$$

$$\begin{aligned}
& + 2 u_0 u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \gamma rho_y \cos\left(\frac{a_{rho}\pi y}{L}\right) \\
& + 2 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) \gamma rho_0 \\
& + 2 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \gamma rho_0 \\
& + 2 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \gamma rho_0 \\
& + 6 \gamma v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) rho_0 \\
& + 6 \gamma v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_0 \\
& + 6 \gamma v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_0 \\
& + 2 \gamma w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) rho_0 \\
& + 2 \gamma w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_0 \\
& + 2 \gamma w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_0 \\
& + 6 \gamma v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_0 rho_z \sin\left(\frac{a_{rho}\pi z}{L}\right) \\
& + 6 \gamma v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_0 rho_x \sin\left(\frac{a_{rho}\pi x}{L}\right) \\
& + 6 \gamma v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_0 rho_y \cos\left(\frac{a_{rho}\pi y}{L}\right) \\
& + 6 \gamma v_0 v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) rho_z \sin\left(\frac{a_{rho}\pi z}{L}\right) \\
& + 6 \gamma v_0 v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) rho_x \sin\left(\frac{a_{rho}\pi x}{L}\right) \\
& + 6 \gamma v_0 v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) rho_y \cos\left(\frac{a_{rho}\pi y}{L}\right) \\
& + 6 \gamma v_0 v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_z \sin\left(\frac{a_{rho}\pi z}{L}\right) \\
& + 6 \gamma v_0 v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_x \sin\left(\frac{a_{rho}\pi x}{L}\right) \\
& + 6 \gamma v_0 v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_y \cos\left(\frac{a_{rho}\pi y}{L}\right) \\
& - 6 v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) rho_z \sin\left(\frac{a_{rho}\pi z}{L}\right)
\end{aligned}$$

$$\begin{aligned}
& -6 v_z \sin\left(\frac{a_vz\pi z}{L}\right) v_x \cos\left(\frac{a_vx\pi x}{L}\right) rho_x \sin\left(\frac{a_rhox\pi x}{L}\right) \\
& -6 v_z \sin\left(\frac{a_vz\pi z}{L}\right) v_x \cos\left(\frac{a_vx\pi x}{L}\right) rho_y \cos\left(\frac{a_rhoy\pi y}{L}\right) \\
& -6 v_z \sin\left(\frac{a_vz\pi z}{L}\right) v_y \sin\left(\frac{a_vy\pi y}{L}\right) rho_z \sin\left(\frac{a_rhoz\pi z}{L}\right) \\
& -6 v_z \sin\left(\frac{a_vz\pi z}{L}\right) v_y \sin\left(\frac{a_vy\pi y}{L}\right) rho_x \sin\left(\frac{a_rhox\pi x}{L}\right) \\
& -6 v_z \sin\left(\frac{a_vz\pi z}{L}\right) v_y \sin\left(\frac{a_vy\pi y}{L}\right) rho_y \cos\left(\frac{a_rhoy\pi y}{L}\right) \\
& -6 v_x \cos\left(\frac{a_vx\pi x}{L}\right) v_y \sin\left(\frac{a_vy\pi y}{L}\right) rho_z \sin\left(\frac{a_rhoz\pi z}{L}\right) \\
& -6 v_x \cos\left(\frac{a_vx\pi x}{L}\right) v_y \sin\left(\frac{a_vy\pi y}{L}\right) rho_x \sin\left(\frac{a_rhox\pi x}{L}\right) \\
& -6 v_x \cos\left(\frac{a_vx\pi x}{L}\right) v_y \sin\left(\frac{a_vy\pi y}{L}\right) rho_y \cos\left(\frac{a_rhoy\pi y}{L}\right) \\
& -2 w_z \cos\left(\frac{a_wz\pi z}{L}\right) w_x \sin\left(\frac{a_wx\pi x}{L}\right) rho_z \sin\left(\frac{a_rhoz\pi z}{L}\right) \\
& -2 w_z \cos\left(\frac{a_wz\pi z}{L}\right) w_x \sin\left(\frac{a_wx\pi x}{L}\right) rho_x \sin\left(\frac{a_rhox\pi x}{L}\right) \\
& -2 w_z \cos\left(\frac{a_wz\pi z}{L}\right) w_x \sin\left(\frac{a_wx\pi x}{L}\right) rho_y \cos\left(\frac{a_rhoy\pi y}{L}\right) \\
& -2 w_z \cos\left(\frac{a_wz\pi z}{L}\right) w_y \sin\left(\frac{a_wy\pi y}{L}\right) rho_z \sin\left(\frac{a_rhoz\pi z}{L}\right) \\
& -2 w_z \cos\left(\frac{a_wz\pi z}{L}\right) w_y \sin\left(\frac{a_wy\pi y}{L}\right) rho_x \sin\left(\frac{a_rhox\pi x}{L}\right) \\
& -2 w_z \cos\left(\frac{a_wz\pi z}{L}\right) w_y \sin\left(\frac{a_wy\pi y}{L}\right) rho_y \cos\left(\frac{a_rhoy\pi y}{L}\right) \\
& -2 w_x \sin\left(\frac{a_wx\pi x}{L}\right) w_y \sin\left(\frac{a_wy\pi y}{L}\right) rho_z \sin\left(\frac{a_rhoz\pi z}{L}\right) \\
& -2 w_x \sin\left(\frac{a_wx\pi x}{L}\right) w_y \sin\left(\frac{a_wy\pi y}{L}\right) rho_x \sin\left(\frac{a_rhox\pi x}{L}\right) \\
& -2 w_x \sin\left(\frac{a_wx\pi x}{L}\right) w_y \sin\left(\frac{a_wy\pi y}{L}\right) rho_y \cos\left(\frac{a_rhoy\pi y}{L}\right) \\
& +2 \gamma w_z \cos\left(\frac{a_wz\pi z}{L}\right) w_0 rho_z \sin\left(\frac{a_rhoz\pi z}{L}\right) \\
& +2 \gamma w_z \cos\left(\frac{a_wz\pi z}{L}\right) w_0 rho_x \sin\left(\frac{a_rhox\pi x}{L}\right) \\
& +2 \gamma w_z \cos\left(\frac{a_wz\pi z}{L}\right) w_0 rho_y \cos\left(\frac{a_rhoy\pi y}{L}\right)
\end{aligned}$$

$$\begin{aligned}
& + 2 \gamma w_0 w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& + 2 \gamma w_0 w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + 2 \gamma w_0 w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& + 2 \gamma w_0 w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& + 2 \gamma w_0 w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& - 2 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) rho_0 \\
& - 2 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) rho_0 \\
& - 2 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) rho_0 \\
& + 2 u_0 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) \gamma rho_0 + 2 u_0 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) \gamma rho_0 \\
& + 2 u_0 u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \gamma rho_0 \\
& - 2 u_0 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& - 2 u_0 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& - 2 u_0 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& - 2 u_0 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& - 2 u_0 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& - 2 u_0 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& - 2 u_0 u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& - 2 u_0 u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& - 2 u_0 u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& + u_x^2 \sin\left(\frac{a_{ux}\pi x}{L}\right)^2 \gamma rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right)
\end{aligned}$$

$$\begin{aligned}
& + u_x^2 \sin\left(\frac{a_{ux}\pi x}{L}\right)^2 \gamma rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + u_x^2 \sin\left(\frac{a_{ux}\pi x}{L}\right)^2 \gamma rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& + u_y^2 \cos\left(\frac{a_{uy}\pi y}{L}\right)^2 \gamma rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& + u_y^2 \cos\left(\frac{a_{uy}\pi y}{L}\right)^2 \gamma rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + u_y^2 \cos\left(\frac{a_{uy}\pi y}{L}\right)^2 \gamma rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& + u_z^2 \cos\left(\frac{a_{uz}\pi z}{L}\right)^2 \gamma rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& + u_z^2 \cos\left(\frac{a_{uz}\pi z}{L}\right)^2 \gamma rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + u_z^2 \cos\left(\frac{a_{uz}\pi z}{L}\right)^2 \gamma rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& - 6 v_0 v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& - 6 v_0 v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& - 6 v_0 v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& - 6 v_0 v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& - 6 v_0 v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& - 6 v_0 v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& - 6 v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_0 rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& - 6 v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_0 rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& - 6 v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_0 rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& - 2 w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) w_0 rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& - 2 w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) w_0 rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& - 2 w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) w_0 rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right)
\end{aligned}$$

$$\begin{aligned}
& -2 w_0 w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& -2 w_0 w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& -2 w_0 w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& -2 w_0 w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& -2 w_0 w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& -2 w_0 w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& + 3 \gamma v_z^2 \sin\left(\frac{a_{vz}\pi z}{L}\right)^2 rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& + 3 \gamma v_z^2 \sin\left(\frac{a_{vz}\pi z}{L}\right)^2 rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + 3 \gamma v_z^2 \sin\left(\frac{a_{vz}\pi z}{L}\right)^2 rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& + 3 \gamma v_x^2 \cos\left(\frac{a_{vx}\pi x}{L}\right)^2 rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& + 3 \gamma v_x^2 \cos\left(\frac{a_{vx}\pi x}{L}\right)^2 rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + 3 \gamma v_x^2 \cos\left(\frac{a_{vx}\pi x}{L}\right)^2 rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& + 3 \gamma v_y^2 \sin\left(\frac{a_{vy}\pi y}{L}\right)^2 rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& + 3 \gamma v_y^2 \sin\left(\frac{a_{vy}\pi y}{L}\right)^2 rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + 3 \gamma v_y^2 \sin\left(\frac{a_{vy}\pi y}{L}\right)^2 rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& + 6 \gamma v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_0 rho_0 + 6 \gamma v_0 v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) rho_0 \\
& + 6 \gamma v_0 v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_0 \\
& - 6 v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) rho_0 \\
& - 6 v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_0 \\
& - 6 v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_0
\end{aligned}$$

$$\begin{aligned}
& + \gamma w_z^2 \cos\left(\frac{a_wz\pi z}{L}\right)^2 rho_z \sin\left(\frac{a_rhoz\pi z}{L}\right) \\
& + \gamma w_z^2 \cos\left(\frac{a_wz\pi z}{L}\right)^2 rho_x \sin\left(\frac{a_rhox\pi x}{L}\right) \\
& + \gamma w_z^2 \cos\left(\frac{a_wz\pi z}{L}\right)^2 rho_y \cos\left(\frac{a_rhooy\pi y}{L}\right) \\
& + \gamma w_x^2 \sin\left(\frac{a_wx\pi x}{L}\right)^2 rho_z \sin\left(\frac{a_rhoz\pi z}{L}\right) \\
& + \gamma w_x^2 \sin\left(\frac{a_wx\pi x}{L}\right)^2 rho_x \sin\left(\frac{a_rhox\pi x}{L}\right) \\
& + \gamma w_x^2 \sin\left(\frac{a_wx\pi x}{L}\right)^2 rho_y \cos\left(\frac{a_rhooy\pi y}{L}\right) \\
& + \gamma w_y^2 \sin\left(\frac{a_wy\pi y}{L}\right)^2 rho_z \sin\left(\frac{a_rhoz\pi z}{L}\right) \\
& + \gamma w_y^2 \sin\left(\frac{a_wy\pi y}{L}\right)^2 rho_x \sin\left(\frac{a_rhox\pi x}{L}\right) \\
& + \gamma w_y^2 \sin\left(\frac{a_wy\pi y}{L}\right)^2 rho_y \cos\left(\frac{a_rhooy\pi y}{L}\right) \\
& - 2 w_z \cos\left(\frac{a_wz\pi z}{L}\right) w_x \sin\left(\frac{a_wx\pi x}{L}\right) rho_0 \\
& - 2 w_z \cos\left(\frac{a_wz\pi z}{L}\right) w_y \sin\left(\frac{a_wy\pi y}{L}\right) rho_0 \\
& - 2 w_x \sin\left(\frac{a_wx\pi x}{L}\right) w_y \sin\left(\frac{a_wy\pi y}{L}\right) rho_0 \\
& + 2 \gamma w_z \cos\left(\frac{a_wz\pi z}{L}\right) w_0 rho_0 + 2 \gamma w_0 w_x \sin\left(\frac{a_wx\pi x}{L}\right) rho_0 \\
& + 2 \gamma w_0 w_y \sin\left(\frac{a_wy\pi y}{L}\right) rho_0 \\
& + 2 u_x \sin\left(\frac{a_ux\pi x}{L}\right) u_y \cos\left(\frac{a_uy\pi y}{L}\right) \gamma rho_z \sin\left(\frac{a_rhoz\pi z}{L}\right) \\
& + 2 u_x \sin\left(\frac{a_ux\pi x}{L}\right) u_y \cos\left(\frac{a_uy\pi y}{L}\right) \gamma rho_x \sin\left(\frac{a_rhox\pi x}{L}\right) \\
& + 2 u_x \sin\left(\frac{a_ux\pi x}{L}\right) u_y \cos\left(\frac{a_uy\pi y}{L}\right) \gamma rho_y \cos\left(\frac{a_rhooy\pi y}{L}\right) \\
& + 2 u_x \sin\left(\frac{a_ux\pi x}{L}\right) u_z \cos\left(\frac{a_uz\pi z}{L}\right) \gamma rho_z \sin\left(\frac{a_rhoz\pi z}{L}\right) \\
& + 2 u_x \sin\left(\frac{a_ux\pi x}{L}\right) u_z \cos\left(\frac{a_uz\pi z}{L}\right) \gamma rho_x \sin\left(\frac{a_rhox\pi x}{L}\right) \\
& + 2 u_x \sin\left(\frac{a_ux\pi x}{L}\right) u_z \cos\left(\frac{a_uz\pi z}{L}\right) \gamma rho_y \cos\left(\frac{a_rhooy\pi y}{L}\right)
\end{aligned}$$

$$\begin{aligned}
& + 2 \gamma w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_y \cos\left(\frac{a_{rho}\pi y}{L}\right) \\
& - u_\theta^2 rho_x \sin\left(\frac{a_{rho}\pi x}{L}\right) - u_\theta^2 rho_y \cos\left(\frac{a_{rho}\pi y}{L}\right) \\
& - u_x^2 \sin\left(\frac{a_{ux}\pi x}{L}\right)^2 rho_0 - u_y^2 \cos\left(\frac{a_{uy}\pi y}{L}\right)^2 rho_0 \\
& - u_z^2 \cos\left(\frac{a_{uz}\pi z}{L}\right)^2 rho_0 + u_\theta^2 \gamma rho_0 - 3 v_\theta^2 rho_z \sin\left(\frac{a_{rho}\pi z}{L}\right) \\
& - 3 v_\theta^2 rho_x \sin\left(\frac{a_{rho}\pi x}{L}\right) - 3 v_\theta^2 rho_y \cos\left(\frac{a_{rho}\pi y}{L}\right) \\
& - w_\theta^2 rho_z \sin\left(\frac{a_{rho}\pi z}{L}\right) - w_\theta^2 rho_x \sin\left(\frac{a_{rho}\pi x}{L}\right) \\
& - w_\theta^2 rho_y \cos\left(\frac{a_{rho}\pi y}{L}\right) + 3 \gamma v_\theta^2 rho_0 + \gamma w_\theta^2 rho_0 \\
& - 3 v_z^2 \sin\left(\frac{a_{vz}\pi z}{L}\right)^2 rho_0 - 3 v_x^2 \cos\left(\frac{a_{vx}\pi x}{L}\right)^2 rho_0 \\
& - 3 v_y^2 \sin\left(\frac{a_{vy}\pi y}{L}\right)^2 rho_0 - w_z^2 \cos\left(\frac{a_{wz}\pi z}{L}\right)^2 rho_0 \\
& - w_x^2 \sin\left(\frac{a_{wx}\pi x}{L}\right)^2 rho_0 - w_y^2 \sin\left(\frac{a_{wy}\pi y}{L}\right)^2 rho_0 \\
& - 2 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) rho_z \sin\left(\frac{a_{rho}\pi z}{L}\right) + 2 p_0 \gamma \\
& + 2 p_x \cos\left(\frac{a_{px}\pi x}{L}\right) \gamma + 2 p_y \sin\left(\frac{a_{py}\pi y}{L}\right) \gamma + 2 p_z \cos\left(\frac{a_{pz}\pi z}{L}\right) \gamma \\
& v_y \cos\left(\frac{a_{vy}\pi y}{L}\right) a_{vy} \pi \Big) + \left(\left(w_0 + w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) \right. \right. \\
& \left. \left. + w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) + w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) \right) \left(\right. \right. \\
& - \cos\left(\frac{a_{vz}\pi z}{L}\right) v_z \left(rho_0 + rho_x \sin\left(\frac{a_{rho}\pi x}{L}\right) \right. \\
& \left. \left. + rho_y \cos\left(\frac{a_{rho}\pi y}{L}\right) + rho_z \sin\left(\frac{a_{rho}\pi z}{L}\right) \right)^2 \left(v_0 \right. \right. \\
& \left. \left. + v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) + v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) + v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) \right) \right. \\
& \left. \left. + \cos\left(\frac{a_{vz}\pi z}{L}\right) v_z \left(rho_0 + rho_x \sin\left(\frac{a_{rho}\pi x}{L}\right) \right. \right. \\
& \left. \left. + rho_y \cos\left(\frac{a_{rho}\pi y}{L}\right) + rho_z \sin\left(\frac{a_{rho}\pi z}{L}\right) \right)^2 \left(v_0 \right. \right. \\
& \left. \left. + v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) + v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) + v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) \right) \right) \gamma \Big) a_{vz} \pi \Big)
\end{aligned}$$

$$\begin{aligned}
& \left/ \left((\gamma - 1) L \left(\rho_0 + \rho_x \sin \left(\frac{a_{rho} \pi x}{L} \right) + \rho_y \cos \left(\frac{a_{rho} \pi y}{L} \right) \right. \right. \right. \\
& \left. \left. \left. + \rho_z \sin \left(\frac{a_{rho} \pi z}{L} \right) \right) \right) + \left(\left(u_0 + u_x \sin \left(\frac{a_{ux} \pi x}{L} \right) \right. \right. \\
& \left. \left. + u_y \cos \left(\frac{a_{uy} \pi y}{L} \right) + u_z \cos \left(\frac{a_{uz} \pi z}{L} \right) \right) \left(\right. \right. \\
& \left. \left. - \cos \left(\frac{a_{wx} \pi x}{L} \right) w_x \left(\rho_0 + \rho_x \sin \left(\frac{a_{rho} \pi x}{L} \right) \right. \right. \\
& \left. \left. + \rho_y \cos \left(\frac{a_{rho} \pi y}{L} \right) + \rho_z \sin \left(\frac{a_{rho} \pi z}{L} \right) \right)^2 \left(w_0 \right. \right. \\
& \left. \left. + w_x \sin \left(\frac{a_{wx} \pi x}{L} \right) + w_y \sin \left(\frac{a_{wy} \pi y}{L} \right) + w_z \cos \left(\frac{a_{wz} \pi z}{L} \right) \right) \right. \\
& \left. \left. + \cos \left(\frac{a_{wx} \pi x}{L} \right) w_x \left(\rho_0 + \rho_x \sin \left(\frac{a_{rho} \pi x}{L} \right) \right. \right. \\
& \left. \left. + \rho_y \cos \left(\frac{a_{rho} \pi y}{L} \right) + \rho_z \sin \left(\frac{a_{rho} \pi z}{L} \right) \right)^2 \left(w_0 \right. \right. \\
& \left. \left. + w_x \sin \left(\frac{a_{wx} \pi x}{L} \right) + w_y \sin \left(\frac{a_{wy} \pi y}{L} \right) + w_z \cos \left(\frac{a_{wz} \pi z}{L} \right) \right) \gamma \right) \\
& a_{wx} \pi \left/ \left((\gamma - 1) L \left(\rho_0 + \rho_x \sin \left(\frac{a_{rho} \pi x}{L} \right) \right. \right. \right. \\
& \left. \left. \left. + \rho_y \cos \left(\frac{a_{rho} \pi y}{L} \right) + \rho_z \sin \left(\frac{a_{rho} \pi z}{L} \right) \right) \right) + \left(\left(v_0 \right. \right. \\
& \left. \left. + v_x \cos \left(\frac{a_{vx} \pi x}{L} \right) + v_y \sin \left(\frac{a_{vy} \pi y}{L} \right) + v_z \sin \left(\frac{a_{vz} \pi z}{L} \right) \right) \left(\right. \right. \\
& \left. \left. - \cos \left(\frac{a_{wy} \pi y}{L} \right) w_y \left(\rho_0 + \rho_x \sin \left(\frac{a_{rho} \pi x}{L} \right) \right. \right. \\
& \left. \left. + \rho_y \cos \left(\frac{a_{rho} \pi y}{L} \right) + \rho_z \sin \left(\frac{a_{rho} \pi z}{L} \right) \right)^2 \left(w_0 \right. \right. \\
& \left. \left. + w_x \sin \left(\frac{a_{wx} \pi x}{L} \right) + w_y \sin \left(\frac{a_{wy} \pi y}{L} \right) + w_z \cos \left(\frac{a_{wz} \pi z}{L} \right) \right) \right. \\
& \left. \left. + \cos \left(\frac{a_{wy} \pi y}{L} \right) w_y \left(\rho_0 + \rho_x \sin \left(\frac{a_{rho} \pi x}{L} \right) \right. \right. \\
& \left. \left. + \rho_y \cos \left(\frac{a_{rho} \pi y}{L} \right) + \rho_z \sin \left(\frac{a_{rho} \pi z}{L} \right) \right)^2 \left(w_0 \right. \right. \\
& \left. \left. + w_x \sin \left(\frac{a_{wx} \pi x}{L} \right) + w_y \sin \left(\frac{a_{wy} \pi y}{L} \right) + w_z \cos \left(\frac{a_{wz} \pi z}{L} \right) \right) \gamma \right) \\
& a_{wy} \pi \left/ \left((\gamma - 1) L \left(\rho_0 + \rho_x \sin \left(\frac{a_{rho} \pi x}{L} \right) \right. \right. \right. \\
& \left. \left. \left. + \rho_y \cos \left(\frac{a_{rho} \pi y}{L} \right) + \rho_z \sin \left(\frac{a_{rho} \pi z}{L} \right) \right) \right) - \frac{1}{2} \frac{1}{L(\gamma - 1)} \left(\left(\right. \right. \\
\end{aligned}$$

$$\begin{aligned}
& - u_0^2 \rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) - u_0^2 \rho_0 - v_0^2 \rho_0 - 3 w_0^2 \rho_0 \\
& - 2 u_0 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) \rho_0 - 2 u_0 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) \rho_0 \\
& - 2 u_0 u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \rho_0 \\
& - u_x^2 \sin\left(\frac{a_{ux}\pi x}{L}\right)^2 \rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& - u_x^2 \sin\left(\frac{a_{ux}\pi x}{L}\right)^2 \rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& - u_x^2 \sin\left(\frac{a_{ux}\pi x}{L}\right)^2 \rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& - u_y^2 \cos\left(\frac{a_{uy}\pi y}{L}\right)^2 \rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& - u_y^2 \cos\left(\frac{a_{uy}\pi y}{L}\right)^2 \rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& - u_y^2 \cos\left(\frac{a_{uy}\pi y}{L}\right)^2 \rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& - u_z^2 \cos\left(\frac{a_{uz}\pi z}{L}\right)^2 \rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& - u_z^2 \cos\left(\frac{a_{uz}\pi z}{L}\right)^2 \rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& - u_z^2 \cos\left(\frac{a_{uz}\pi z}{L}\right)^2 \rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& + u_0^2 \gamma \rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) + u_0^2 \gamma \rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + u_0^2 \gamma \rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) + u_x^2 \sin\left(\frac{a_{ux}\pi x}{L}\right)^2 \gamma \rho_0 \\
& + u_y^2 \cos\left(\frac{a_{uy}\pi y}{L}\right)^2 \gamma \rho_0 + u_z^2 \cos\left(\frac{a_{uz}\pi z}{L}\right)^2 \gamma \rho_0 \\
& + \gamma v_0^2 \rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) + \gamma v_0^2 \rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + \gamma v_0^2 \rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) - 2 v_0 v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) \rho_0 \\
& - 2 v_0 v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) \rho_0 - 2 v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_0 \rho_0 \\
& + 3 \gamma w_0^2 \rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) + 3 \gamma w_0^2 \rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + 3 \gamma w_0^2 \rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) - 6 w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) w_0 \rho_0
\end{aligned}$$

$$\begin{aligned}
& -6 w_0 w_x \sin\left(\frac{a_w x \pi x}{L}\right) rho_0 - 6 w_0 w_y \sin\left(\frac{a_w y \pi y}{L}\right) rho_0 \\
& - v_z^2 \sin\left(\frac{a_v z \pi z}{L}\right)^2 rho_z \sin\left(\frac{a_r h o z \pi z}{L}\right) \\
& - v_z^2 \sin\left(\frac{a_v z \pi z}{L}\right)^2 rho_x \sin\left(\frac{a_r h o x \pi x}{L}\right) \\
& - v_z^2 \sin\left(\frac{a_v z \pi z}{L}\right)^2 rho_y \cos\left(\frac{a_r h o y \pi y}{L}\right) \\
& - v_x^2 \cos\left(\frac{a_v x \pi x}{L}\right)^2 rho_z \sin\left(\frac{a_r h o z \pi z}{L}\right) \\
& - v_x^2 \cos\left(\frac{a_v x \pi x}{L}\right)^2 rho_x \sin\left(\frac{a_r h o x \pi x}{L}\right) \\
& - v_x^2 \cos\left(\frac{a_v x \pi x}{L}\right)^2 rho_y \cos\left(\frac{a_r h o y \pi y}{L}\right) \\
& - v_y^2 \sin\left(\frac{a_v y \pi y}{L}\right)^2 rho_z \sin\left(\frac{a_r h o z \pi z}{L}\right) \\
& - v_y^2 \sin\left(\frac{a_v y \pi y}{L}\right)^2 rho_x \sin\left(\frac{a_r h o x \pi x}{L}\right) \\
& - v_y^2 \sin\left(\frac{a_v y \pi y}{L}\right)^2 rho_y \cos\left(\frac{a_r h o y \pi y}{L}\right) \\
& - 3 w_z^2 \cos\left(\frac{a_w z \pi z}{L}\right)^2 rho_z \sin\left(\frac{a_r h o z \pi z}{L}\right) \\
& - 3 w_z^2 \cos\left(\frac{a_w z \pi z}{L}\right)^2 rho_x \sin\left(\frac{a_r h o x \pi x}{L}\right) \\
& - 3 w_z^2 \cos\left(\frac{a_w z \pi z}{L}\right)^2 rho_y \cos\left(\frac{a_r h o y \pi y}{L}\right) \\
& - 3 w_x^2 \sin\left(\frac{a_w x \pi x}{L}\right)^2 rho_z \sin\left(\frac{a_r h o z \pi z}{L}\right) \\
& - 3 w_x^2 \sin\left(\frac{a_w x \pi x}{L}\right)^2 rho_x \sin\left(\frac{a_r h o x \pi x}{L}\right) \\
& - 3 w_x^2 \sin\left(\frac{a_w x \pi x}{L}\right)^2 rho_y \cos\left(\frac{a_r h o y \pi y}{L}\right) \\
& - 3 w_y^2 \sin\left(\frac{a_w y \pi y}{L}\right)^2 rho_z \sin\left(\frac{a_r h o z \pi z}{L}\right) \\
& - 3 w_y^2 \sin\left(\frac{a_w y \pi y}{L}\right)^2 rho_x \sin\left(\frac{a_r h o x \pi x}{L}\right) \\
& - 3 w_y^2 \sin\left(\frac{a_w y \pi y}{L}\right)^2 rho_y \cos\left(\frac{a_r h o y \pi y}{L}\right) \\
& + \gamma v_z^2 \sin\left(\frac{a_v z \pi z}{L}\right)^2 rho_0 + \gamma v_x^2 \cos\left(\frac{a_v x \pi x}{L}\right)^2 rho_0
\end{aligned}$$

$$\begin{aligned}
& + \gamma v_y^2 \sin\left(\frac{a_{vy}\pi y}{L}\right)^2 rho_0 + 3 \gamma w_z^2 \cos\left(\frac{a_{wz}\pi z}{L}\right)^2 rho_0 \\
& + 3 \gamma w_x^2 \sin\left(\frac{a_{wx}\pi x}{L}\right)^2 rho_0 + 3 \gamma w_y^2 \sin\left(\frac{a_{wy}\pi y}{L}\right)^2 rho_0 \\
& + 6 \gamma w_0 w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_y \cos\left(\frac{a_{rho_y}\pi y}{L}\right) \\
& - 2 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) rho_x \sin\left(\frac{a_{rho_x}\pi x}{L}\right) \\
& - 2 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) rho_y \cos\left(\frac{a_{rho_y}\pi y}{L}\right) \\
& - 2 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) rho_z \sin\left(\frac{a_{rho_z}\pi z}{L}\right) \\
& - 2 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) rho_x \sin\left(\frac{a_{rho_x}\pi x}{L}\right) \\
& - 2 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) rho_y \cos\left(\frac{a_{rho_y}\pi y}{L}\right) \\
& - 2 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) rho_z \sin\left(\frac{a_{rho_z}\pi z}{L}\right) \\
& - 2 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) rho_x \sin\left(\frac{a_{rho_x}\pi x}{L}\right) \\
& - 2 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) rho_y \cos\left(\frac{a_{rho_y}\pi y}{L}\right) \\
& + 2 u_0 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) \gamma rho_z \sin\left(\frac{a_{rho_z}\pi z}{L}\right) \\
& + 2 u_0 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) \gamma rho_x \sin\left(\frac{a_{rho_x}\pi x}{L}\right) \\
& + 2 u_0 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) \gamma rho_y \cos\left(\frac{a_{rho_y}\pi y}{L}\right) \\
& + 2 u_0 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) \gamma rho_z \sin\left(\frac{a_{rho_z}\pi z}{L}\right) \\
& + 2 u_0 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) \gamma rho_x \sin\left(\frac{a_{rho_x}\pi x}{L}\right) \\
& + 2 u_0 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) \gamma rho_y \cos\left(\frac{a_{rho_y}\pi y}{L}\right) \\
& + 2 u_0 u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \gamma rho_z \sin\left(\frac{a_{rho_z}\pi z}{L}\right) \\
& + 2 u_0 u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \gamma rho_x \sin\left(\frac{a_{rho_x}\pi x}{L}\right) \\
& + 2 u_0 u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \gamma rho_y \cos\left(\frac{a_{rho_y}\pi y}{L}\right)
\end{aligned}$$

$$\begin{aligned}
& + 2 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) \gamma rho_0 \\
& + 2 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \gamma rho_0 \\
& + 2 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \gamma rho_0 \\
& + 2 \gamma v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) rho_0 \\
& + 2 \gamma v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_0 \\
& + 2 \gamma v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_0 \\
& + 6 \gamma w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) rho_0 \\
& + 6 \gamma w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_0 \\
& + 6 \gamma w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_0 \\
& + 2 \gamma v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_0 rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& + 2 \gamma v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_0 rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + 2 \gamma v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_0 rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& + 2 \gamma v_0 v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& + 2 \gamma v_0 v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + 2 \gamma v_0 v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& + 2 \gamma v_0 v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& + 2 \gamma v_0 v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + 2 \gamma v_0 v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& - 2 v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& - 2 v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right)
\end{aligned}$$

$$\begin{aligned}
& -2 v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& -2 v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& -2 v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& -2 v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& -2 v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& -2 v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& -2 v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& -6 w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& -6 w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& -6 w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& -6 w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& -6 w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& -6 w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& -6 w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& -6 w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& -6 w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& +6 \gamma w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) w_0 rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& +6 \gamma w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) w_0 rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& +6 \gamma w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) w_0 rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& +6 \gamma w_0 w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right)
\end{aligned}$$

$$\begin{aligned}
& + 6 \gamma w_0 w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + 6 \gamma w_0 w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& + 6 \gamma w_0 w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& + 6 \gamma w_0 w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& - 2 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) rho_0 \\
& - 2 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) rho_0 \\
& - 2 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) rho_0 \\
& + 2 u_0 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) \gamma rho_0 + 2 u_0 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) \gamma rho_0 \\
& + 2 u_0 u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) \gamma rho_0 \\
& - 2 u_0 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& - 2 u_0 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& - 2 u_0 u_x \sin\left(\frac{a_{ux}\pi x}{L}\right) rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& - 2 u_0 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& - 2 u_0 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& - 2 u_0 u_y \cos\left(\frac{a_{uy}\pi y}{L}\right) rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& - 2 u_0 u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& - 2 u_0 u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& - 2 u_0 u_z \cos\left(\frac{a_{uz}\pi z}{L}\right) rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& + u_x^2 \sin\left(\frac{a_{ux}\pi x}{L}\right)^2 \gamma rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& + u_x^2 \sin\left(\frac{a_{ux}\pi x}{L}\right)^2 \gamma rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right)
\end{aligned}$$

$$\begin{aligned}
& + u_x^2 \sin\left(\frac{a_{ux}\pi x}{L}\right)^2 \gamma rho_y \cos\left(\frac{a_{rho}\pi y}{L}\right) \\
& + u_y^2 \cos\left(\frac{a_{uy}\pi y}{L}\right)^2 \gamma rho_z \sin\left(\frac{a_{rho}\pi z}{L}\right) \\
& + u_y^2 \cos\left(\frac{a_{uy}\pi y}{L}\right)^2 \gamma rho_x \sin\left(\frac{a_{rho}\pi x}{L}\right) \\
& + u_y^2 \cos\left(\frac{a_{uy}\pi y}{L}\right)^2 \gamma rho_y \cos\left(\frac{a_{rho}\pi y}{L}\right) \\
& + u_z^2 \cos\left(\frac{a_{uz}\pi z}{L}\right)^2 \gamma rho_z \sin\left(\frac{a_{rho}\pi z}{L}\right) \\
& + u_z^2 \cos\left(\frac{a_{uz}\pi z}{L}\right)^2 \gamma rho_x \sin\left(\frac{a_{rho}\pi x}{L}\right) \\
& + u_z^2 \cos\left(\frac{a_{uz}\pi z}{L}\right)^2 \gamma rho_y \cos\left(\frac{a_{rho}\pi y}{L}\right) \\
& - 2 v_0 v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) rho_z \sin\left(\frac{a_{rho}\pi z}{L}\right) \\
& - 2 v_0 v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) rho_x \sin\left(\frac{a_{rho}\pi x}{L}\right) \\
& - 2 v_0 v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) rho_y \cos\left(\frac{a_{rho}\pi y}{L}\right) \\
& - 2 v_0 v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_z \sin\left(\frac{a_{rho}\pi z}{L}\right) \\
& - 2 v_0 v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_x \sin\left(\frac{a_{rho}\pi x}{L}\right) \\
& - 2 v_0 v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_y \cos\left(\frac{a_{rho}\pi y}{L}\right) \\
& - 2 v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_0 rho_z \sin\left(\frac{a_{rho}\pi z}{L}\right) \\
& - 2 v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_0 rho_x \sin\left(\frac{a_{rho}\pi x}{L}\right) \\
& - 2 v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_0 rho_y \cos\left(\frac{a_{rho}\pi y}{L}\right) \\
& - 6 w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) w_0 rho_z \sin\left(\frac{a_{rho}\pi z}{L}\right) \\
& - 6 w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) w_0 rho_x \sin\left(\frac{a_{rho}\pi x}{L}\right) \\
& - 6 w_z \cos\left(\frac{a_{wz}\pi z}{L}\right) w_0 rho_y \cos\left(\frac{a_{rho}\pi y}{L}\right) \\
& - 6 w_0 w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) rho_z \sin\left(\frac{a_{rho}\pi z}{L}\right)
\end{aligned}$$

$$\begin{aligned}
& -6 w_0 w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& -6 w_0 w_x \sin\left(\frac{a_{wx}\pi x}{L}\right) rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& -6 w_0 w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& -6 w_0 w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& -6 w_0 w_y \sin\left(\frac{a_{wy}\pi y}{L}\right) rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& + \gamma v_z^2 \sin\left(\frac{a_{vz}\pi z}{L}\right)^2 rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& + \gamma v_z^2 \sin\left(\frac{a_{vz}\pi z}{L}\right)^2 rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + \gamma v_z^2 \sin\left(\frac{a_{vz}\pi z}{L}\right)^2 rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& + \gamma v_x^2 \cos\left(\frac{a_{vx}\pi x}{L}\right)^2 rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& + \gamma v_x^2 \cos\left(\frac{a_{vx}\pi x}{L}\right)^2 rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + \gamma v_x^2 \cos\left(\frac{a_{vx}\pi x}{L}\right)^2 rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& + \gamma v_y^2 \sin\left(\frac{a_{vy}\pi y}{L}\right)^2 rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right) \\
& + \gamma v_y^2 \sin\left(\frac{a_{vy}\pi y}{L}\right)^2 rho_x \sin\left(\frac{a_{rhox}\pi x}{L}\right) \\
& + \gamma v_y^2 \sin\left(\frac{a_{vy}\pi y}{L}\right)^2 rho_y \cos\left(\frac{a_{rhoy}\pi y}{L}\right) \\
& + 2 \gamma v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_0 rho_0 + 2 \gamma v_0 v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) rho_0 \\
& + 2 \gamma v_0 v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_0 \\
& - 2 v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) rho_0 \\
& - 2 v_z \sin\left(\frac{a_{vz}\pi z}{L}\right) v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_0 \\
& - 2 v_x \cos\left(\frac{a_{vx}\pi x}{L}\right) v_y \sin\left(\frac{a_{vy}\pi y}{L}\right) rho_0 \\
& + 3 \gamma w_z^2 \cos\left(\frac{a_{wz}\pi z}{L}\right)^2 rho_z \sin\left(\frac{a_{rhoz}\pi z}{L}\right)
\end{aligned}$$

$$\begin{aligned}
& + 3 \gamma w_z^2 \cos\left(\frac{a_w z \pi z}{L}\right)^2 rho_x \sin\left(\frac{a_r h o x \pi x}{L}\right) \\
& + 3 \gamma w_z^2 \cos\left(\frac{a_w z \pi z}{L}\right)^2 rho_y \cos\left(\frac{a_r h o y \pi y}{L}\right) \\
& + 3 \gamma w_x^2 \sin\left(\frac{a_w x \pi x}{L}\right)^2 rho_z \sin\left(\frac{a_r h o z \pi z}{L}\right) \\
& + 3 \gamma w_x^2 \sin\left(\frac{a_w x \pi x}{L}\right)^2 rho_x \sin\left(\frac{a_r h o x \pi x}{L}\right) \\
& + 3 \gamma w_x^2 \sin\left(\frac{a_w x \pi x}{L}\right)^2 rho_y \cos\left(\frac{a_r h o y \pi y}{L}\right) \\
& + 3 \gamma w_y^2 \sin\left(\frac{a_w y \pi y}{L}\right)^2 rho_z \sin\left(\frac{a_r h o z \pi z}{L}\right) \\
& + 3 \gamma w_y^2 \sin\left(\frac{a_w y \pi y}{L}\right)^2 rho_x \sin\left(\frac{a_r h o x \pi x}{L}\right) \\
& + 3 \gamma w_y^2 \sin\left(\frac{a_w y \pi y}{L}\right)^2 rho_y \cos\left(\frac{a_r h o y \pi y}{L}\right) \\
& - 6 w_z \cos\left(\frac{a_w z \pi z}{L}\right) w_x \sin\left(\frac{a_w x \pi x}{L}\right) rho_0 \\
& - 6 w_z \cos\left(\frac{a_w z \pi z}{L}\right) w_y \sin\left(\frac{a_w y \pi y}{L}\right) rho_0 \\
& - 6 w_x \sin\left(\frac{a_w x \pi x}{L}\right) w_y \sin\left(\frac{a_w y \pi y}{L}\right) rho_0 \\
& + 6 \gamma w_z \cos\left(\frac{a_w z \pi z}{L}\right) w_0 rho_0 + 6 \gamma w_0 w_x \sin\left(\frac{a_w x \pi x}{L}\right) rho_0 \\
& + 6 \gamma w_0 w_y \sin\left(\frac{a_w y \pi y}{L}\right) rho_0 \\
& + 2 u_x \sin\left(\frac{a_u x \pi x}{L}\right) u_y \cos\left(\frac{a_u y \pi y}{L}\right) \gamma rho_z \sin\left(\frac{a_r h o z \pi z}{L}\right) \\
& + 2 u_x \sin\left(\frac{a_u x \pi x}{L}\right) u_y \cos\left(\frac{a_u y \pi y}{L}\right) \gamma rho_x \sin\left(\frac{a_r h o x \pi x}{L}\right) \\
& + 2 u_x \sin\left(\frac{a_u x \pi x}{L}\right) u_y \cos\left(\frac{a_u y \pi y}{L}\right) \gamma rho_y \cos\left(\frac{a_r h o y \pi y}{L}\right) \\
& + 2 u_x \sin\left(\frac{a_u x \pi x}{L}\right) u_z \cos\left(\frac{a_u z \pi z}{L}\right) \gamma rho_z \sin\left(\frac{a_r h o z \pi z}{L}\right) \\
& + 2 u_x \sin\left(\frac{a_u x \pi x}{L}\right) u_z \cos\left(\frac{a_u z \pi z}{L}\right) \gamma rho_x \sin\left(\frac{a_r h o x \pi x}{L}\right) \\
& + 2 u_x \sin\left(\frac{a_u x \pi x}{L}\right) u_z \cos\left(\frac{a_u z \pi z}{L}\right) \gamma rho_y \cos\left(\frac{a_r h o y \pi y}{L}\right) \\
& + 2 u_y \cos\left(\frac{a_u y \pi y}{L}\right) u_z \cos\left(\frac{a_u z \pi z}{L}\right) \gamma rho_z \sin\left(\frac{a_r h o z \pi z}{L}\right)
\end{aligned}$$

$$\begin{aligned}
& - u_{_0}^2 \rho_{_x} \sin\left(\frac{a_{_rho} x \pi x}{L}\right) - u_{_0}^2 \rho_{_y} \cos\left(\frac{a_{_rho} y \pi y}{L}\right) \\
& - u_{_x}^2 \sin\left(\frac{a_{_ux} \pi x}{L}\right)^2 \rho_{_0} - u_{_y}^2 \cos\left(\frac{a_{_uy} \pi y}{L}\right)^2 \rho_{_0} \\
& - u_{_z}^2 \cos\left(\frac{a_{_uz} \pi z}{L}\right)^2 \rho_{_0} + u_{_0}^2 \gamma \rho_{_0} - v_{_0}^2 \rho_{_z} \sin\left(\frac{a_{_rho} z \pi z}{L}\right) \\
& - v_{_0}^2 \rho_{_x} \sin\left(\frac{a_{_rho} x \pi x}{L}\right) - v_{_0}^2 \rho_{_y} \cos\left(\frac{a_{_rho} y \pi y}{L}\right) \\
& - 3 w_{_0}^2 \rho_{_z} \sin\left(\frac{a_{_rho} z \pi z}{L}\right) - 3 w_{_0}^2 \rho_{_x} \sin\left(\frac{a_{_rho} x \pi x}{L}\right) \\
& - 3 w_{_0}^2 \rho_{_y} \cos\left(\frac{a_{_rho} y \pi y}{L}\right) + \gamma v_{_0}^2 \rho_{_0} + 3 \gamma w_{_0}^2 \rho_{_0} \\
& - v_{_z}^2 \sin\left(\frac{a_{_vz} \pi z}{L}\right)^2 \rho_{_0} - v_{_x}^2 \cos\left(\frac{a_{_vx} \pi x}{L}\right)^2 \rho_{_0} \\
& - v_{_y}^2 \sin\left(\frac{a_{_vy} \pi y}{L}\right)^2 \rho_{_0} - 3 w_{_z}^2 \cos\left(\frac{a_{_wz} \pi z}{L}\right)^2 \rho_{_0} \\
& - 3 w_{_x}^2 \sin\left(\frac{a_{_wx} \pi x}{L}\right)^2 \rho_{_0} - 3 w_{_y}^2 \sin\left(\frac{a_{_wy} \pi y}{L}\right)^2 \rho_{_0} \\
& - 2 u_{_x} \sin\left(\frac{a_{_ux} \pi x}{L}\right) u_{_y} \cos\left(\frac{a_{_uy} \pi y}{L}\right) \rho_{_z} \sin\left(\frac{a_{_rho} z \pi z}{L}\right) + 2 p_{_0} \gamma \\
& + 2 p_{_x} \cos\left(\frac{a_{_px} \pi x}{L}\right) \gamma + 2 p_{_y} \sin\left(\frac{a_{_py} \pi y}{L}\right) \gamma + 2 p_{_z} \cos\left(\frac{a_{_pz} \pi z}{L}\right) \gamma \\
& w_{_z} \sin\left(\frac{a_{_wz} \pi z}{L}\right) a_{_wz} \pi
\end{aligned}$$