1. $$\frac{\tilde{d}\rho_a}{dt} = \sum_{b\in A} \frac{m_b}{\rho_b} \left(\rho_a\ \tilde{\mathbf{u}}_{ab}\ +\ \left(\rho\ (\tilde{\mathbf{u}}\ -\ \mathbf{u})\right)_{ab}\right)\ \cdot \nabla_a W_{ab}$$

2. $$\frac{\tilde{d}\mathbf{u}_a}{dt} = -\sum_{b\in A} m_b \left[\left(\frac{p_a}{\rho_a^2} + \frac{p_b}{\rho_b^2}\right)\mathbf{I} - \left(\frac{\boldsymbol{\sigma}'_a}{\rho_a^2} + \frac{\boldsymbol{\sigma}'_b}{\rho_b^2} + \Pi_{ab}\mathbf{I}\right)\right] \cdot \nabla_a W_{ab} + \mathbf{g}_a + \frac{1}{m_a}\sum_{b\in B} \mathbf{F}^{\text{contact}}_{a\leftarrow b}$$

3. $$\nabla \mathbf{u}_a = -\sum_{b\in A} \frac{m_b}{\rho_b}(\mathbf{u}_a - \mathbf{u}_b) \otimes (\nabla_a W_{ab})$$