1 General monodomain model: without level set

Conservation of energy (Nonlinear Heat Transfer)

$$\frac{\partial \langle \rho h \rangle}{\partial t} + \langle \vec{v^l} \rangle \cdot \nabla \left(\rho^l h^l \right) + \nabla \cdot \left(\langle \kappa \rangle \vec{\nabla} T \right) = 0$$

T^t

Microsegregation (Direct lever rule or discrete mapping)

$$w^l = w^{l*} = k w^{s*} = k w^s$$
$$w^s = w^{s*} = \frac{w_0}{k(1 - f^s) + f^s}$$

$(g^l)^t, (w_i^l)^t, (w_i^s)^t$

Conservation of chemical species (Macrosegregation)

$$\frac{\partial \langle \rho w_i \rangle}{\partial t} + \nabla \cdot \langle \rho w_i \vec{v^l} \rangle + \nabla \cdot \left(g^l D^l \vec{\nabla} w_i^l \right) = 0$$

$\langle w_i \rangle^t$

Conservation of liquid momentum (Navier Stokes)

$$\begin{cases} \frac{\partial}{\partial t} \left(\rho^l \langle \vec{v^l} \rangle \right) + \frac{1}{g^l} \vec{\nabla} \cdot \left(\rho^l \langle \vec{v^l} \rangle \times \langle \vec{v^l} \rangle \right) = \\ - g^l \vec{\nabla} p^l - 2\mu^l \vec{\nabla} \cdot \left(\overline{\overline{\nabla}} \langle \vec{v^l} \rangle + \overline{\overline{\nabla^t}} \langle \vec{v^l} \rangle \right) - g^l \mu^l \mathbb{K}^{-1} \langle \vec{v^l} \rangle + g^l \rho^l \vec{g} \\ \\ \nabla \cdot \langle \vec{v^l} \rangle = 0 \end{cases}$$

$\langle \vec{v^l} \rangle^t, (p^l)^t$

2 General multidomain model: with level set