
Algorithm 1: Computation of Right Hand Sides.

Data: c_R^p, c_R^s .
Result: $\mathbf{rhsLm}, \mathbf{rhsF}$.
1 Update of $\mathbf{w}, \mathbf{F}_\psi, J_\psi, \mathbf{H}_\psi$
2 $\mathbf{F} = \mathbf{F}_\phi \mathbf{F}_\psi^{-1}$
3 $\mathbf{P} = \mathbf{P}(\mathbf{F})$
4 $\mathbf{v} = J_\psi^{-1} \mathbf{p}_x / \rho$
5 $\hat{\mathbf{v}} = \mathbf{v} + [(\mathbf{F}_\phi \mathbf{F}_\psi^{-1}) \cdot \mathbf{w}]$
6 $\hat{\mathbf{P}} = [\mathbf{P} + ((\mathbf{v}\rho) \otimes \mathbf{w})]$
7 \mathbf{vC} , point to edge interpolation of $\hat{\mathbf{v}}$
8 $\Lambda_{\mathbf{H}_\phi}^2 = (\mathbf{H}_\psi^{Ave} \mathbf{N}_x) \cdot (\mathbf{H}_\psi^{Ave} \mathbf{N}_x)$
9 $c_x^p = J_\psi^{-1} [\Lambda_{\mathbf{H}_\phi} c_R^p - \mathbf{w} \cdot (\mathbf{H}_\psi \mathbf{N}_x)]$
10 $c_x^s = J_\psi^{-1} [\Lambda_{\mathbf{H}_\phi} c_R^s - \mathbf{w} \cdot (\mathbf{H}_\psi \mathbf{N}_x)]$
11 $\mathbf{tC} = \hat{\mathbf{P}}^{Ave} \mathbf{N}_x + \frac{1}{2} \mathbf{Sm}at(c_x^p, c_x^s) (\mathbf{p}_x^+ - \mathbf{p}_x^-)$
12 $\mathbf{rhsLm} = \sum_{b \in \Lambda_a} (\mathbf{tC} \parallel C_{ab}^x \parallel)$
13 $\mathbf{rhsF} = \sum_{b \in \Lambda_a} (\mathbf{vC} \otimes \mathbf{C}_{ab}^x)$

Algorithm 2: Use of Right Hand Sides.

Data: $\mathbf{rhsLm}, \mathbf{rhsF}$.
Result: $\mathbf{p}_x^n, \mathbf{F}_\phi^n, \mathbf{u}^n, \mathbf{u}_w^n$
1 $\mathbf{v} = J_\psi^{-1} \mathbf{p}_x / \rho$
2 $\hat{\mathbf{v}} = \mathbf{v} + [(\mathbf{F}_\phi \mathbf{F}_\psi^{-1}) \cdot \mathbf{w}]$
3 $\mathbf{x} += \Delta t \hat{\mathbf{v}}$
4 $\mathbf{x}_w += \Delta t \hat{\mathbf{w}}$
5 $\mathbf{p}_x += \Delta t \mathbf{rhsLm}$
6 $\mathbf{F} += \Delta t \mathbf{rhsF}$
7 $\mathbf{p}_x^n = \frac{1}{2} (\mathbf{p}_x^{n-1} + \mathbf{p}_x^n)$
8 $\mathbf{F}_\phi^n = \frac{1}{2} (\mathbf{F}_\phi^{n-1} + \mathbf{F}_\phi^n)$
9 $\mathbf{x}^n = \frac{1}{2} (\mathbf{x}^{n-1} + \mathbf{x}^n)$
10 $\mathbf{x}_w^n = \frac{1}{2} (\mathbf{x}_w^{n-1} + \mathbf{x}_w^n)$
11 $\mathbf{u}^n = \mathbf{x}^n - \mathbf{X}$
12 $\mathbf{u}_w^n = \mathbf{x}_w^n - \mathbf{X}$
