Algorithm 1: Computation of Right Hand Sides.

Data: c_R^p, c_R^s .

Result: rhsLm, rhsF.

- 1 Update of $\boldsymbol{w}, \boldsymbol{F_{\psi}}, J_{\psi}, \boldsymbol{H_{\psi}}$
- $oldsymbol{F} = oldsymbol{F}_{\phi} oldsymbol{F}_{\psi}^{-1}$
- з $oldsymbol{P} = oldsymbol{P}(oldsymbol{F})$
- 4 $v = J_{\psi}^{-1} p_x / \rho$
- 5 $\hat{m{v}} = m{v} + \left[\left(m{F}_{\!\phi} m{F}_{\!\psi}^{-1}
 ight) \cdot m{w}
 ight]$
- 6 $\hat{\boldsymbol{P}} = [\boldsymbol{P} + ((\boldsymbol{v}\rho) \otimes \boldsymbol{w})]$
- 7 vC, point to edge interpolation of \hat{v}
- 8 $\Lambda_{m{H}_{m{\phi}}}^2 = \left(m{H}_{\psi}^{Ave}m{N_x}
 ight)\cdot\left(m{H}_{\psi}^{Ave}m{N_x}
 ight)$

- $\mathbf{9} \ c_{\boldsymbol{x}}^{p} = J_{\psi}^{-1} \left[\Lambda_{\boldsymbol{H}_{\phi}} c_{R}^{p} \boldsymbol{w} \cdot (\boldsymbol{H}_{\psi} \boldsymbol{N}_{\boldsymbol{x}}) \right]$ $\mathbf{10} \ c_{\boldsymbol{x}}^{s} = J_{\psi}^{-1} \left[\Lambda_{\boldsymbol{H}_{\phi}} c_{R}^{s} \boldsymbol{w} \cdot (\boldsymbol{H}_{\psi} \boldsymbol{N}_{\boldsymbol{x}}) \right]$ $\mathbf{11} \ \boldsymbol{tC} = \hat{\boldsymbol{P}}^{Ave} \boldsymbol{N}_{\boldsymbol{x}} + \frac{1}{2} Smat(c_{\boldsymbol{x}}^{p}, c_{\boldsymbol{x}}^{s}) \left(\boldsymbol{p}_{\boldsymbol{x}}^{+} \boldsymbol{p}_{\boldsymbol{x}}^{-}\right)$ $\mathbf{12} \ \boldsymbol{rhsLm} = \sum_{b \in \Lambda_{a}} \left(\boldsymbol{tC} \ || C_{ab}^{\boldsymbol{x}} || \right)$
- 13 $m{rhsF} = \sum\limits_{b \in \Lambda_a} (m{vC} \otimes m{\mathcal{C}}^{m{x}}_{ab})$

Algorithm 2: Use of Right Hand Sides.

Data: rhsLm, rhsF.

Result: $p_x^n, F_\phi^n, u^n, u_w^n$

- 1 $v = J_{\psi}^{-1} p_{x} / \rho$
- 2 $\hat{m{v}} = m{v} + \left[\left(m{F}_{\phi} m{F}_{\psi}^{-1}
 ight) \cdot m{w}
 ight]$
- з $\boldsymbol{x} += \Delta t \, \hat{\boldsymbol{v}}$
- $\mathbf{a} \ \mathbf{x}_{\mathbf{w}} \mathrel{+}= \Delta t \ \hat{\mathbf{w}}$
- 5 $p_x += \Delta t \ rhsLm$
- 6 $\boldsymbol{F} += \Delta t \ \boldsymbol{rhsF}$
- 7 $oldsymbol{p}_{oldsymbol{x}}^n = rac{1}{2} \left(oldsymbol{p}_{oldsymbol{x}}^{n-1} + oldsymbol{p}_{oldsymbol{x}}^n
 ight)$
- 8 $oldsymbol{F}_{\phi}^n=rac{1}{2}ig(oldsymbol{F}_{\phi}^{n-1}+oldsymbol{F}_{\phi}^nig)$ 9 $oldsymbol{x}^n=rac{1}{2}ig(oldsymbol{x}^{n-1}+oldsymbol{x}^nig)$
- 10 $m{x}_{m{w}}^n = rac{1}{2} \left(m{x}_{m{w}}^{n-1} + m{x}_{m{w}}^n
 ight)$
- 11 $oldsymbol{u}^n = oldsymbol{x}^n oldsymbol{X}$
- 12 $oldsymbol{u}_{oldsymbol{w}}^n = oldsymbol{x}_{oldsymbol{w}}^n oldsymbol{X}$