

$$\mathbf{v}'_k = \Gamma^+ [\mathbf{v}_k; \zeta_v] \equiv \boxed{\mathbf{v}_k \odot \exp\left(\frac{\varepsilon_v^k}{2} s_v^k(\zeta_{\mathbf{v}_k})\right)}_{\text{v scaling}} - \frac{\varepsilon_v^k}{2} \left[\partial_x S(x_k) \odot \exp\left(\varepsilon_v^k q_v^k(\zeta_{\mathbf{v}_k})\right) \right]_{\text{force scaling}} + \boxed{t_v^k(\zeta_{\mathbf{v}_k})}_{\text{translation}}$$

$$\mathbf{x}'_k = m^k \odot \mathbf{x}_k + \bar{m}^k \odot \Lambda^+ [\bar{\mathbf{x}}_k; \zeta_{\bar{\mathbf{x}}}] \equiv \boxed{\bar{\mathbf{x}}_k \odot \exp\left(\varepsilon_{\bar{\mathbf{x}}}^k s_{\bar{\mathbf{x}}}^k(\zeta_{\bar{\mathbf{x}}_k})\right)}_{\text{x scaling}} + \varepsilon_{\bar{\mathbf{x}}}^k \left[v'_k \odot \exp\left(\varepsilon_{\bar{\mathbf{x}}}^k q_{\bar{\mathbf{x}}}^k(\zeta_{\bar{\mathbf{x}}_k})\right) \right]_{\text{v scaling}} + \boxed{t_{\bar{\mathbf{x}}}^k(\zeta_{\bar{\mathbf{x}}_k})}_{\text{translation}}$$