$$\mathbf{v}'_k = \Gamma^+[\mathbf{v}_k;\, \zeta_v] \equiv \mathbf{v}_k \odot \exp\left(\frac{\varepsilon^k_{\mathbf{v}}}{2} s^k_{\mathbf{v}}(\zeta_{\mathbf{v}_k})\right) - \frac{\varepsilon^k_{\mathbf{v}}}{2}\left[\partial_x S(x_k) \odot \exp\left(\varepsilon^k_{\mathbf{v}} q^k_{\mathbf{v}}(\zeta_{\mathbf{v}_k})\right) + t^k_{\mathbf{v}}(\zeta_{\mathbf{v}_k})\right]$$

$$\mathbf{x}'_k = m^k \odot \mathbf{x}_k + \bar{m}^k \odot \Lambda^+[\bar{\mathbf{x}}_k;\, \zeta_{\bar{\mathbf{x}}}] \equiv \bar{\mathbf{x}}_k \odot \exp\left(\varepsilon^k_{\bar{\mathbf{x}}} s^k_{\mathbf{x}}(\zeta_{\bar{\mathbf{x}}_k})\right) + \varepsilon^k_{\mathbf{x}}\left[v'_k \odot \exp\left(\varepsilon^k_{\mathbf{x}} q^k_{\mathbf{x}}(\zeta_{\bar{\mathbf{x}}_k})\right) + t^k_{\mathbf{x}}(\zeta_{\bar{\mathbf{x}}_k})\right]$$