

$$\text{lhs} = \int (\mathbb{E} [\dot{\pi}_i \mathbf{p}_i + \dot{\pi}_j \mathbf{p}_j + \dot{\pi}_k \mathbf{p}_k] \times \mathcal{L} / @ (X_{i,j} [1] X_{i+1,k} [1] X_{j+1,k+1} [1])) \\ \text{d} \{ \mathbf{p}_i, \mathbf{p}_j, \mathbf{p}_k, \mathbf{x}_i, \mathbf{x}_j, \mathbf{x}_k, \mathbf{p}_{i+1}, \mathbf{p}_{j+1}, \mathbf{p}_{k+1}, \mathbf{x}_{i+1}, \mathbf{x}_{j+1}, \mathbf{x}_{k+1} \};$$

$$\text{rhs} = \int (\mathbb{E} [\dot{\pi}_i \mathbf{p}_i + \dot{\pi}_j \mathbf{p}_j + \dot{\pi}_k \mathbf{p}_k] \times \mathcal{L} / @ (X_{j,k} [1] X_{i,k+1} [1] X_{i+1,j+1} [1])) \\ \text{d} \{ \mathbf{p}_i, \mathbf{p}_j, \mathbf{p}_k, \mathbf{x}_i, \mathbf{x}_j, \mathbf{x}_k, \mathbf{p}_{i+1}, \mathbf{p}_{j+1}, \mathbf{p}_{k+1}, \mathbf{x}_{i+1}, \mathbf{x}_{j+1}, \mathbf{x}_{k+1} \};$$

$$\text{lhs} = \text{rhs}$$