1. 4D Basis Functions

The 4D basis functions up to second order will be given by

$$\phi^{(k)} \in \{1, \xi, \eta, \tau, \nu\}\,. \tag{1}$$

Here, we use the convention that the usual mappings take place between $(x, y, v_x, v_y) \leftrightarrow (\xi, \eta, \tau, \nu)$ for the canonical element.

The Cartesian basis functions (up to second order) are given by:

$$\phi^{(k)}_{2D_{CART}} \in \left\{1, \sqrt{3}\xi, \sqrt{3}\eta\right\} \tag{2}$$