

$$\det \left[\begin{smallmatrix} {}^i\mathfrak{L}^m \\ \partial_k {}^i\mathfrak{L}^m \end{smallmatrix} \right] = \sum_{i_k} \det \frac{{}^i\mathfrak{L}^j}{\omega^{i_k} {}^i\mathfrak{L}^j} \Bigg| \frac{{}^i\mathfrak{L}^\ell}{\omega^{i_k} {}^i\mathfrak{L}^\ell}$$

$$= \sum_I \det \frac{{}^i\mathfrak{L}^j}{{}^i\mathfrak{L}^j} \Bigg| \frac{{}^i\mathfrak{L}^\ell}{{}^i\mathfrak{L}^\ell} \prod_k \omega^{i_k}$$

$$\det \frac{{}^i\mathfrak{L}^j}{{}^i\mathfrak{L}^j} \Bigg| \frac{{}^i\mathfrak{L}^\ell}{{}^i\mathfrak{L}^\ell} \text{ q-form}$$

$$\underline{\Pi}_p \ni \dot{\mathcal{L}}$$

$$\begin{aligned} \dot{\mathcal{L}} \ddot{\times} {}^q\mathfrak{L} \Big| {}_{i_1}\mathfrak{L}^{m_1} \ddot{\times} {}_{i_q}\mathfrak{L}^{m_q} &= \det \frac{{}^1\mathfrak{L}^{m_1}}{\mathfrak{L}^{q m_1}} \Bigg| \frac{{}^1\mathfrak{L}^{m_q}}{\mathfrak{L}^{q m_q}} = \det_k^\ell {}_k\mathfrak{L}^{m_k} \\ \dot{\mathcal{L}} \ddot{\times} {}^q\mathfrak{L} \Big| \det \left[\begin{smallmatrix} {}^i\mathfrak{L}^m \\ {}^i\mathfrak{L}^m \end{smallmatrix} \right] \end{aligned}$$

$$\text{spalt basis } \beta = \beta^1 \cdots \beta^p \in \overset{\sharp}{X}_u^1 \supset \Omega_\beta$$

$$w\in iX_u^1+\Omega_\beta^>$$

$$\text{dual zeil basis } w_1 \cdots w_p \in Z_u^1$$

$$\begin{aligned} Z_u^1 &\xrightarrow[\text{hol}]{} \mathbb{C} \\ {}^w\widehat{\partial_i 1} &= \frac{{}^w\widehat{\partial 1}}{\partial w^i} = {}^{w+tw_i}\widehat{\partial_t^0 1} \end{aligned}$$

$$\mathfrak{l} \in \mathbb{C} \overset{2}{\triangleleft}_{\Omega}$$

$$\mathfrak{l}_{\Omega_\beta}^\sharp \in {}^{iX_u^1}\!\!\!\triangleleft_{\omega}^2 \mathbb{C}$$

$$\text{closed q-form } \beta^1 \ddot{\times} \beta^p \boxtimes \underline{\beta}^{i_1} \ddot{\times} \underline{\beta}^{i_q} \overbrace{\partial_{i_1} \cdots \partial_{i_q} \mathfrak{l}_{\Omega_\beta}^\sharp}^w$$

$$\gamma \in {}^{iX}\!\!\!\triangleleft_{\omega}^2 \mathbb{C} \Rightarrow \sharp \gamma \in \mathbb{C} \overset{2}{\triangleleft}_{\Omega} \Rightarrow \sharp \gamma_{\Omega_\beta} \in \mathbb{C} \overset{2}{\triangleleft}_{\Omega_\beta}$$

$$\begin{aligned} {}^w\mathfrak{T}_{\Omega_\beta}^\sharp &= \int\limits_{dv}^{iX_u^1} {}^{w-v} \Delta_\beta^{-d_u/r_u} v \gamma \\ &= \beta^1 \ddot{\times} \beta^p \boxtimes \underline{\beta}^{i_1} \ddot{\times} \underline{\beta}^{i_q} \overbrace{\partial_{i_1} \cdots \partial_{i_q} \mathfrak{T}_{\Omega_\beta}^\sharp}^w \end{aligned}$$

$$\begin{aligned} &= \beta^1 \ddot{\times} \beta^p \boxtimes \underline{\beta}^{i_1} \ddot{\times} \underline{\beta}^{i_q} \int\limits_{dv}^{iX_u^1} v \gamma \overbrace{\partial_{i_1} \cdots \partial_{i_q} {}^{w-v} \Delta_\beta^{-d_u/r_u}}^w \\ &= \overbrace{\underline{\beta}^1 \partial_1 + \underline{\beta}^2 \partial_2} \boxtimes \overbrace{\underline{\beta}^1 \partial_1 + \underline{\beta}^2 \partial_2} = \begin{bmatrix} \underline{\beta}^1 \partial_1 + \underline{\beta}^2 \partial_2 \\ \underline{\beta}^1 \partial_1 + \underline{\beta}^2 \partial_2 \end{bmatrix} \times \begin{bmatrix} \underline{\beta}^1 \partial_1 + \underline{\beta}^2 \partial_2 \\ \underline{\beta}^1 \partial_1 + \underline{\beta}^2 \partial_2 \end{bmatrix} \end{aligned}$$

$$\begin{aligned} &= \overbrace{\underline{\beta}^1 \partial_1 + \underline{\beta}^2 \partial_2} \times \overbrace{\underline{\beta}^1 \partial_1 + \underline{\beta}^2 \partial_2} = \overbrace{\underline{\beta}^1 \times \underline{\beta}^1} \partial_1^2 + \overbrace{\underline{\beta}^1 \times \underline{\beta}^2 + \underline{\beta}^2 \times \underline{\beta}^1} \partial_2 \partial_1 + \overbrace{\underline{\beta}^2 \times \underline{\beta}^2} \partial_2^2 \end{aligned}$$