$$\det \begin{bmatrix} {}_{i}\upharpoonleft^{m} \\ \partial^{i}_{k}\, {}_{i\_}\upharpoonleft^{m} \end{bmatrix} = \sum_{i_k} \det \frac{{}_{i}\upharpoonleft^{j}}{\omega^{i_k}\, {}_{i_k\_}\upharpoonleft^{j}} \left| \frac{{}_{i}\upharpoonleft^{\ell}}{\omega^{i_k}\, {}_{i_k\_}\upharpoonleft^{\ell}} \right.$$

$$= \sum_{I} \det \frac{{}_{i}\upharpoonleft^{j}}{{}_{i_k\_}\upharpoonleft^{j}} \left| \frac{{}_{i}\upharpoonleft^{\ell}}{{}_{i_k\_}\upharpoonleft^{\ell}} \right. \prod_{k} \omega^{i_k}$$

$$\det \frac{{}_{i}\upharpoonleft^{j}}{{}_{i_k\_}\upharpoonleft^{j}} \left| \frac{{}_{i}\upharpoonleft^{\ell}}{{}_{i_k\_}\upharpoonleft^{\ell}} \right. \quad \text{q-form}$$

$$\underline{\Pi}_{p} \ni \dot{\upharpoonleft}$$

$$\overset{1}{\upharpoonleft} \ddot{\bowtie} \overset{q}{\upharpoonleft} \,|\, {}_{i_1\_}\upharpoonleft^{m_1} \ddot{\bowtie} {}_{i_q\_}\upharpoonleft^{m_q} = \det \frac{{}_{i_1}\overset{1}{\upharpoonleft}^{m_1}}{{}_{i_1}\overset{q}{\upharpoonleft}^{m_1}} \left| \frac{{}_{i_q}\overset{1}{\upharpoonleft}^{m_q}}{{}_{i_q}\overset{q}{\upharpoonleft}^{m_q}} \right. = \det_{k}^{\ell} \, {}_{i_k}\overset{\ell}{\upharpoonleft}^{m_k}$$

$$\overset{1}{\upharpoonleft} \ddot{\bowtie} \overset{q}{\upharpoonleft} \,|\, \det \begin{bmatrix} {}_{i}\upharpoonleft^{m} \\ {}_{i_k\_}\upharpoonleft^{m} \end{bmatrix}$$

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

$$w \in i\,X_u^1 + \Omega_\beta^>$$

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

$$Z_u^1 \xrightarrow[\text{hol}]{\upharpoonleft} \mathbb{C}$$

$$^{w}\overbrace{\partial_i \upharpoonleft} = {}^{w}\overbrace{\frac{\partial \upharpoonleft}{\partial w^i}} = {}^{w+tw_i}\overbrace{\partial_t^0 \upharpoonleft}$$

$$\iota \in \mathbb{C}^{\overset{2}{\triangledown}}{}_{\Omega}$$

$$\iota^\sharp_{\Omega_\beta} \in {}^{iX_u^1}\underset{\omega}{\overset{2}{\triangle}}\mathbb{C}$$

$$\text{closed q-form } \beta^1 \,\ddot{\bowtie}\, \beta^p \bowtie \underline{\beta}^{i_1} \,\ddot{\bowtie}\, \underline{\beta}^{i_q} \; {}^{w}\overbrace{\partial_{i_1} \cdots \partial_{i_q} \iota^\sharp_{\Omega_\beta}}$$

$$\upharpoonleft \in {}^{iX}\underset{\omega}{\overset{2}{\triangle}}\mathbb{C} \Rightarrow {}_\sharp\upharpoonleft \in \mathbb{C}^{\overset{2}{\triangledown}}{}_{\Omega} \Rightarrow {}_\sharp\upharpoonleft_{\Omega_\beta} \in \mathbb{C}^{\overset{2}{\triangledown}}{}_{\Omega_\beta}$$

$$^{w}{}_\sharp\upharpoonleft^\sharp_{\Omega_\beta} = \int_{dv}^{iX_u^1} {}^{w-v}\Delta_\beta^{-d_u/r_u} \, {}^{v}\upharpoonleft$$

$$\beta^1 \,\ddot{\bowtie}\, \beta^p \bowtie \underline{\beta}^{i_1} \,\ddot{\bowtie}\, \underline{\beta}^{i_q} \; {}^{w}\overbrace{\partial_{i_1} \cdots \partial_{i_q \sharp} \upharpoonleft^\sharp_{\Omega_\beta}}$$

$$= \beta^1 \,\ddot{\bowtie}\, \beta^p \bowtie \underline{\beta}^{i_1} \,\ddot{\bowtie}\, \underline{\beta}^{i_q} \int_{dv}^{iX_u^1} {}^{v}\upharpoonleft \; {}^{w}\overbrace{\partial_{i_1} \cdots \partial_{i_q} {}^{w-v}\Delta_\beta^{-d_u/r_u}}$$

$$\overbrace{\underline{\beta}^1\partial_1 + \underline{\beta}^2\partial_2} \bowtie \overbrace{\underline{\beta}^1\partial_1 + \underline{\beta}^2\partial_2} = \begin{bmatrix} \beta^1_{-1}\partial_1 + \beta^2_{-1}\partial_2 \\ \beta^1_{-2}\partial_1 + \beta^2_{-2}\partial_2 \end{bmatrix} \times \begin{bmatrix} \beta^1_{-1}\partial_1 + \beta^2_{-1}\partial_2 \\ \beta^1_{-2}\partial_1 + \beta^2_{-2}\partial_2 \end{bmatrix}$$

$$= \overbrace{\beta^1_{-1}\partial_1 + \beta^2_{-1}\partial_2} \times \overbrace{\beta^1_{-2}\partial_1 + \beta^2_{-2}\partial_2} = \overbrace{\beta^1_{-1} \times \beta^1_{-2}}\,\partial_1^2 + \overbrace{\beta^1_{-1} \times \beta^2_{-2} + \beta^2_{-1} \times \beta^1_{-2}}\,\partial_2\,\partial_1 + \overbrace{\beta^2_{-1} \times \beta^2_{-2}}\,\partial_2^2$$