connected and we can set

$$\pi(s) = \int_{s_0}^{s} \omega$$

to obtain a holomorphic function π in Δ with $d\pi = \omega$. Consider the meromorphic differential $\pi \cdot \eta$ on Δ; since η is smooth on the arcs δ_i, the integral of $\pi \cdot \eta$ along the boundary of Δ is well-defined, and by the same argument as used in the first reciprocity law

$$\int_{\partial\Delta} \pi \cdot \eta = \sum_{i=1}^{g} (\Pi^{i} N^{g+i} - \Pi^{g+i} N^{i}).$$

「 What's the difference? Same 」

On the other hand, near a singular point p of η with local coordinate z as above,

$$\pi(z) = \int_{s_0}^{z} \omega = b_0^p z + \frac{1}{2} b_1^p z^2 + \frac{1}{3} b_2^p z^3 + \cdots$$

So that

$$\int_{\partial\Delta} \pi \cdot \eta = 2\pi\sqrt{-1} \sum_p \mathrm{Res}_p(\pi \cdot \eta) = 2\pi\sqrt{-1} \sum_p \left[\sum_{j=2}^{n} \frac{a_{-j}^p \cdot b_{j-2}^p}{j-1} \right].$$

「 $\pi \cdot \eta = \cdots + \frac{1}{z}\left(b_0^p \cdot a_{-2}^p + \frac{1}{2} b_1^p \cdot a_{-3}^p + \frac{1}{3} b_2^p \cdot a_{-4}^p + \cdots \right.$

$\left. + \frac{1}{n-1} b_{-n+2-4}^p a_{-n}^p \right) + \cdots$

$\Rightarrow \int_p \pi \cdot \eta = \sum_{j=2}^{n} \frac{a_{-j}^p b_{j-2}^p}{j-1}.$ 」

Thus we have the reciprocity law for differentials of

