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A note on Reidemeister torsion and period matrix of Riemann surfaces

Reidemeister torsion is a topological invariant and was first introduced by Reidemeister [8] in 1935. He classified $3-$dimensional lens spaces by using this combinatorial invariant of CW-complexes. Later, Franz [4] generalized Reidemeister torsion and classified the higher dimensional lens spaces. In 1964, de Rham [3] extended the results of Reidemeister and Franz to the spaces of constant curvature 1.

The topological invariance of the torsion for manifold was proved in 1969 by Kirby and Siebenmann [5]. For arbitrary simplicial complex it was proved by Chapman [1, 2]. Thus, the classification of lens spaces of Reidemeister and Franz was actually topological (i.e. up to homeomorphism).

In 1961, by using the torsion, Milnor disproved *Hauptvermutung*. He constructed two homeomorphic but combinatorially distinct finite simplicial complexes. Later in 1962, Milnor identified the Reidemeister torsion with Alexander polynomial [6]. Since then, as a topological invariant, torsion has a very useful application in knot theory and links.

We [10] presented an explanation of the relation mentioned in [11] between a symplectic chain complex with $\omega-$compatible bases and Reidemeister torsion of it. We also [10] applied our theoretical result to the chain-complex

$$0 \to \mathscr{C}_2(\Sigma_g; \mathrm{Ad}_\varrho) \stackrel{\partial_2 \otimes id}{\to} \mathscr{C}_1(\Sigma_g; \mathrm{Ad}_\varrho) \stackrel{\partial_1 \otimes id}{\to} \mathscr{C}_0(\Sigma_g; \mathrm{Ad}_\varrho) \to 0$$

where Σ_g is a compact Riemann surface of genus $g > 1$, $\varrho : \pi_1(\Sigma_g) \to \mathrm{PSL}_2(\mathbb{R})$ is discrete and faithful representation of the fundamental group $\pi_1(\Sigma_g)$ of Σ_g.

In this study, we shall explain the relation between the Reidemeister torsion of Σ_g and its period matrix.

[1] Chapman T.A. // Bull. Amer. Math. Soc. — 1973. — **79**.

[2] Chapman T.A. // Amer. J. Math. — 1974. — **96**.

[3] de Rham G. Tata Institute and Oxford Univ. Press, 1964.

[4] Franz W. // J. Reine Angew. Math. — 1935. — **173**.

[5] Kirby R.C., Siebenmann L.C. // Bull. Amer. Math. Soc. — 1969. — **75**

[6] Milnor J. // Ann. of Math. — 1962. —.

[7] Milnor J. // Bull. Amer. Math. Soc. — 1966. — **72**.

[8] Reidemeister K. // Abh. Math. Sem. Univ. Hamburg — 1935. — **11**.

[9] Sözen Y. // Osaka J. Math. — 2008. — **45**.

[10] Sözen Y. // Math. Slovaca (accepted)

[11] Witten E. // Comm. Math. Phys. — 1991. — **141**.