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Univalent functions and Teichmüller spaces, by Olli Lehto. Graduate Texts in Mathematics, vol. 109, Springer-Verlag, New York, Berlin, Heidelberg, London, Paris, New York, 1987, xii+257 pp., $46.00. ISBN 0-387-96310-3

Quasiconformal mappings have played a prominent role in geometric function theory for nearly fifty years. We recall that a sense-preserving diffeomorphism f of one plane region D onto another is called a K-quasiconformal map if its differential $f'(x)$, viewed as a linear map of $\mathbf{R}^2$ onto itself, satisfies the inequality

$$\max\{\|f'(x)u\|; \|u\| = 1\} \leq K \min\{\|f'(x)u\|; \|u\| = 1\}$$

at every point in D. A sense-preserving homeomorphism of D into the plane is K-quasiconformal if there is a sequence of K-quasiconformal diffeomorphisms that converges to f uniformly on compact subsets of D. A sense-preserving homeomorphism of one Riemann surface onto another is K-quasiconformal if all its compositions with local charts are K-quasiconformal maps in the plane. Finally, a quasiconformal map is a sense-preserving homeomorphism that is K-quasiconformal for some number $K \geq 1$. It is important to observe that 1-quasiconformal maps are conformal.

In 1939, a fundamental paper of Teichmüller introduced quasiconformal maps to the study of spaces of Riemann surfaces. Choose a compact Riemann surface X of genus $p \geq 2$ and define a pseudometric on the set of all sense-preserving homeomorphisms of X onto Riemann surfaces of the same genus by putting

$$d(f, g) = \log K \tag{1}$$

if K is the smallest number such that there is a K-quasiconformal map in the homotopy class of $g \circ f^{-1}$. The metric space that results from identifying f with g when $d(f, g) = 0$ is Teichmüller's space T_p of marked Riemann surfaces of genus p. Teichmüller proved that T_p is homeomorphic to $\mathbf{R}^{6p-6}$.