

DISSERTATION
DEFENSE

Harmonic measure, reduced extremal length and quasicircles

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Abstract: For a Jordan domain Ω in the extended complex plane $\bar{\mathbb{C}}$, let f_1 and f_2 map Ω and $\Omega^* = \bar{\mathbb{C}} \setminus \bar{\Omega}$ conformally onto the unit disk \mathbb{D} and $\mathbb{D}^* = \bar{\mathbb{C}} \setminus \bar{\mathbb{D}}$, respectively. One can define a homeomorphism of the unit circle as $h_\Omega = f_2 \circ f_1^{-1}|_{\partial\mathbb{D}}$, which is called a sewing homeomorphism induced by a domain Ω . This paper is devoted to the study of some fundamental properties of the sewing homeomorphism induced by a Jordan domain.

In chapter 2, we mainly study two important conformal invariants: the extremal distance and the reduced extremal distance. Gives the estimate of extremal distance in the unit disk and the comparison of these two conformal invariants. In chapter 3 and 4, we give several necessary and sufficient conditions for the sewing homeomorphism of a Jordan domain to be bi-Lipschitz or bi-Hölder, by using harmonic measure, extremal distance and reduced extremal distance. Furthermore, in chapter 5, we obtain some equivalent conditions for a Jordan curve to be a quasicircle. In chapter 6, we use the Robin capacity to define a new index and use this new index to characterize unit circle.

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