

THE ESCAPING SET OF TRANSCENDENTAL SELF-MAPS OF THE PUNCTURED PLANE

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We study the iteration of holomorphic self-maps of C^* , the complex plane with the origin removed, for which both zero and infinity are essential singularities. The escaping set of such maps consists of the points whose orbit accumulates to zero and/or infinity following what we call essential itineraries. We show that the Julia set always contains escaping points with every essential itinerary. The concept of essential itinerary leads to a partition of the escaping set into uncountably many disjoint sets, the boundary of each of which is the Julia set. Under certain hypotheses, each of these sets contains uncountably many curves to zero and infinity. We also use approximation theory to provide examples of functions with escaping Fatou components.