Constructing Entire Functions (a summary)

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August 2, 2015

Constructing Entire Functions By Quasiconformal Folding (a summary)

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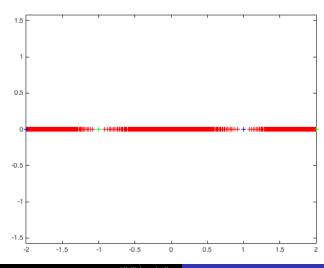
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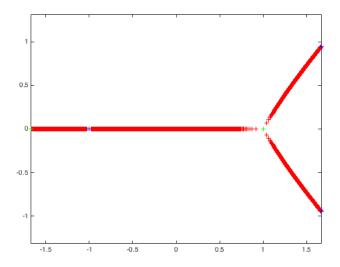
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Shabat polynomial -

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Theorem (*Grothendieck*): ALL combinatorial trees occur as $p^{-1}[-1,1]$ for some Shabat polynomial p(z).

Theorem (Bishop): Any continua can be ϵ -approximated in the Hausdorff metric by some $p^{-1}[-1,1]$.

infinite trees \iff Transcendental Functions

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 $\mathcal{S}_{2,0}\,$ - transcendental functions with two critical values ± 1 and no asymptotic values

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critical values: ± 1

T - unbounded, locally finite tree

 Ω_j - components of $\mathbb{C}-\mathcal{T}$

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- T unbounded, locally finite tree, with a bipartite labeling of vertices.
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Theorem:

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Theorem: Suppose T has bounded geometry and every edge has τ -size $> \pi$.

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Theorem: Suppose T has bounded geometry and every edge has τ -size $\geq \pi$. Then there is an $r_0 > 0$, an entire f, and a K-quasiconformal ϕ so that $f \circ \phi = \cosh \circ \tau$ off $T(r_0)$. K depends only on the bounded geometry constants of T. The only critical values of f are ± 1 and f has no asymptotic values.

 $f:\mathbb{C} o \mathbb{C}$ entire function $f^{\circ n}$ is normal in an open set U

 $f^{\circ n}$ is normal in an open set U if every sequence of $f^{\circ k}$ contains a further subsequence converging locally uniformly to a holomorphic function $g:U\to\overline{\mathbb{C}}$

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A Fatou component U is called wandering if $f^n(U) \cap f^m(U) = \emptyset$

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Theorem: (Golberg and Keen, Eremenko and Lyubich) Functions in the Speiser Class don't have wandering domains.

The Eremenko-Lyubich class ${\cal B}$ consists of those transcendental functions with bounded singular set.

$$S^+ = \{x + iy : x > 0, |y| < \pi/2\}$$

 $S^+ = \{x + iy : x > 0, |y| < \pi/2\}$ is mapped conformally to \mathbb{H}_r by $\lambda \cdot \sinh$.

$$a_n = \cosh^{-1}\left(\frac{\pi}{\lambda} \left\lfloor \frac{\lambda}{\pi} \cosh(n\pi) \right\rfloor\right)$$

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Theorem: For every choice of parameters λ , (d_n) , (w_n) with $\lambda \in \pi \mathbb{N}$, $d_n \in 2\mathbb{N}$

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- (1) $\rho_n(z) = z$ for $z \in \partial \mathbb{D}$
- $(2) \rho_n(0) = w_n$ where w_n is a point near 1/2.
- (3) ρ_n is conformal on $\frac{3}{4}\mathbb{D}$
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Theorem: For every choice of parameters λ , (d_n) , (w_n) with $\lambda \in \pi \mathbb{N}$, $d_n \in 2\mathbb{N}$, there exists a transcendental f and a quasiconformal $\phi : \mathbb{C} \to \mathbb{C}$ so that:

(1)
$$f(\overline{z}) = \overline{f(z)}, f(-z) = f(z)$$

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$$f(z) = \begin{cases} \cosh(\lambda \sinh(\phi(z))) & \text{if } \phi(z) \in S^+\\ \rho_n((\phi(z) - z_n)^{d_n}) & \text{if } \phi(z) \in D_n \end{cases}$$

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 - (4) $\phi(0) = 0, \phi(\mathbb{R}) = \mathbb{R}$ and ϕ is conformal in S^+ .

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