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ON SUFFICIENT CONDITIONS FOR A POLYNOMIAL TO BE SIGN-INDEPENDENTLY HYPERBOLIC OR TO HAVE REAL SEPARATED ZEROS

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The well-known Hutchinson's theorem states that if P be a polynomial with positive coefficients, $P(x) = \sum_{k=0}^{n} a_k x^k$, and $\frac{a_{k-1}^2}{a_{k-2}a_k} \geqslant 4$ for $k = 2, 3, \ldots, n$, then all the zeros of P are real. We obtain sufficient conditions for a real polynomial to be a sign-independently hyperbolic polynomial or to have real separated roots in the style of Hutchinson's theorem.

Joint work with Anna Vishnyakova.

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WIMAN'S INEQUALITY FOR ANALYTIC FUNCTIONS IN $\mathbb{D} \times \mathbb{C}$ WITH RAPIDLY OSCILLATING COEFFICIENTS

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By $\mathcal{A}^2$ we denote the class of analytic functions $f\colon \mathbb{D} \times \mathbb{C} \to \mathbb{C}$, $\mathbb{D} = \{\tau \in \mathbb{C}\colon |\tau| < 1\}$ of the form $f(z) = f(z_1, z_2) = \sum_{n+m=0}^{+\infty} a_{nm} z_1^n z_2^m$, $z = (z_1, z_2)$. For $r = (r_1, r_2) \in T := [0, 1) \times (0, +\infty)$ and $f \in \mathcal{A}^2$ denote

$$\Delta_r = \{t = (t_1, t_2) \in T\colon t_1 \geqslant r_1, t_2 \geqslant r_2\},$$

$\mu_f(r) = \max\{|a_{nm}|r_1^n r_2^m : n, m \geqslant 0\}, M_f(r) = \max\{|f(z)| : |z_1| = r_1, |z_2| = r_2\}$.

Let $\mathcal{K}(f, \theta) = \{f(z,t) = \sum_{n+m=0}^{+\infty} a_{nm} \exp\{2\pi i \theta_{nm} t\} r_1^n r_2^m : t \in \mathbb{R}\}$, where $\{\theta_{nm}\}$ is a sequence of positive integers such that its arrangement $\{\theta_k^*\}$ by increasing, i.e. $\{\theta_{nm} : (n,m) \in \mathbb{Z}_+^2\} = \{\theta_k^* : k \geqslant 0\}$, $\theta_{k+1}^* > \theta_k^*$, satisfies the condition $\theta_{k+1}^*/\theta_k^* \geqslant q > 1$ $(k \geqslant 0)$.

Let $\mathcal{A}_0^2$ be the class of analytic functions $f \in \mathcal{A}^2$ such that $\frac{\partial}{\partial z_2} f(z_1, z_2) \not\equiv 0$ in T. We say that a subset E of $\mathbb{R}^2$ is a *asymptotically finite logarithmic measure* $E \in \mathcal{E}$ if E is the Lebesque measurable in $\mathbb{R}_+^2$ and there exists an $r_0 \in \mathbb{R}_+^2$ such that $E \cap \triangle_{r_0}$ is a set of *finite logarithmic measure*, i.e.

$$\ln_2 - \text{meas}(E \cap \triangle_{r_0}) := \iint\limits_{E \cap \triangle_{r_0}} \frac{dr_1 dr_2}{(1 - r_1) r_2} < +\infty, \ (E \in \mathcal{E}).$$

Theorem 1 ([1]). *Let $f \in \mathcal{A}_0^2$. For every $\delta > 0$ there exists a set $E = E(\delta, f) \subset T, E \in \mathcal{E}$ such that for all $r \in T \backslash E$ we obtain*

$$M_f(r) \leqslant \frac{\mu_f(r)}{(1 - r_1)^{1+\delta}} \ln^{1+\delta} \frac{\mu_f(r)}{1 - r_1} \cdot \ln^{1/2+\delta} r_2.$$

Theorem 2. *Let $f \in \mathcal{A}_0^2$, $f(z,t) \in \mathcal{K}(f,\theta)$. Then almost surely for $t \in \mathbb{R}$ there exist $r_0 \in \mathbb{R}_+^2$ and a set $E \in \mathcal{E}$ such that for all $r \in \Pi(R) \backslash E$ we have*

$$M_f(r, \omega) = \max\{f(z, \omega) : |z| = r\} \leqslant \frac{\mu_f(r)}{(1 - r_1)^{1/2+\delta}} \ln^{1/2+\delta} \frac{\mu_f(r)}{1 - r_1} \cdot \ln^{1/4+\delta} r_2.$$

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QUASI-ELLIPTIC FUNCTIONS

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Denote $\mathbb{C}^* = \mathbb{C} \backslash \{0\}$.

Definition. *A meromorphic in $\mathbb{C}$ function g is called* **quasi-elliptic**, *if there exist $\omega_1, \omega_2 \in \mathbb{C}^*$, $Im \frac{\omega_2}{\omega_1} > 0$, and $p \in \mathbb{C}^*$, $q \in \mathbb{C}^*$, such that for every $u \in \mathbb{C}$*

$$g(u + \omega_1) = pg(u), \ \ g(u + \omega_2) = qg(u).$$

For this class of functions we construct analogues of classic $\wp$, ζ and σ Weierstrass functions. Also a connection between quasi-elliptic and p-loxodromic [1] functions is obtained.