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Optimal Recovery of Analytic Functions from Hardy–Sobolev Spaces

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Denote by $H^r_{\infty,\beta}$ the class of 2π-periodic, analytic in the strip $S_\beta := \{z \in \mathbb{C} : |\operatorname{Im} z| < \beta\}$ functions f, which satisfy the condition $|f^{(r)}(z)| \le 1$, $z \in S_\beta$. We consider the problem of optimal recovery of $f(\xi)$, $\xi \in \mathbb{T} := [0, 2\pi)$, using the information $If = (l_1 f, \dots, l_n f)$, where $l_j f$ are the Fourier coefficients of f or function values at a fixed system of nodes from $\mathbb{T}$.

We calculate the intrinsic error

$$e(\xi, H^r_{\infty,\beta}, I) := \inf_{S:\mathbb{C}^n \to \mathbb{C}} \sup_{f \in H^r_{\infty,\beta}} |f(\xi) - S(If)|$$

and find an optimal algorithm of recovery S_0 for which the infimum is attained. To obtain optimal recovery algorithms we use a method based on parametrization of extremal functions in the dual extremal problem

$$\sup_{\substack{f \in H^r_{\infty,\beta} \\ If = 0}} |f(\xi)|.$$