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Intersection bounds for planar Neumann eigenfunctions with interior analytic curves

Let $\Omega \subset \mathbb{R}^2$ be a bounded piecewise smooth domain and ϕ_λ be a Neumann (or Dirichlet) eigenfunction with eigenvalue λ^2 and nodal set $\mathcal{N}_{\phi_\lambda} = \{x \in \Omega; \phi_\lambda(x) = 0\}$. Let $H \subset \Omega$ be an interior C^ω curve. Consider the intersection number

$$n(\lambda, H) := \#(H \cap \mathcal{N}_{\phi_\lambda}).$$

We first prove that for general piecewise-analytic domains, and under an appropriate “goodness” condition on H ,

$$n(\lambda, H) = \mathcal{O}_H(\lambda) \quad (*)$$

as $\lambda \rightarrow \infty$. We then prove that the bound in $(*)$ is satisfied in the case of quantum ergodic (QE) sequences of interior eigenfunctions, provided Ω is convex and H has strictly positive geodesic curvature.