İSTANBUL ANALYSIS SEMINARS

CHARACTERIZATION OF POTENTIAL SMOOTHNESS AND RIESZ BASIS PROPERTY OF HILL-SCHRŐDINGER OPERATORS WITH SINGULAR PERIODIC POTENTIALS IN TERMS OF PERIODIC, ANTIPERIODIC AND NEUMANN SPECTRA

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Abstract: The Hill-Schrődinger operators $Ly = -y'' + v(x)y$ considered with singular complex valued π-periodic potentials v of the form $v = Q'$ with $Q \in L^2([0,\pi])$, and subject to periodic, antiperiodic or Neumann boundary conditions have discrete spectra. For sufficiently large n, the disc $\{z : |z - n^2| < n\}$ contains two periodic (if n is even) or antiperiodic (if n is odd) eigenvalues λ_n^-, λ_n^+ and one Neumann eigenvalue ν_n. We show that the rate of decay of $|\lambda_n^+ - \lambda_n^-| + |\lambda_n^+ - \nu_n|$ determines the potential smoothness, and there is a basis consisting of periodic (or antiperiodic) root functions if and only if for even (respectively, odd) n, $\sup_{\lambda_n^+ \neq \lambda_n^-}\{|\lambda_n^+ - \nu_n|/|\lambda_n^+ - \lambda_n^-|\} < \infty$. These assertions extend and generalize our previous results proven under the assumption $v \in L^p([0,\pi])$, $p > 1$.

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