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APPLICATION OF THE EXACT INVERSE OF THE TOEPLITZ MATRIX WITH SINGULAR RATIONAL SYMBOL RANDOM WALKS

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Abstract: In the paper we study the random walks $\sum_{i=0}^{n} X_i$ on the interval $[0, N] \subset Z$, where X_i are i.i.d. random variables with characteristic function $\Phi = (l - \cos\theta)|f|^2$. Here f is a rational function. We consider more precisely the case

$$\Phi = (1 - \cos\theta)\frac{A}{|1 - ae^{\mathrm{i}\theta}|^2}, \quad 0 < a < 1.$$

where the distribution of the random variable X_i is characterized. Using the results of previous works on the inverses of the Toeplitz matrices with singular symbol of rational regular part, we compute exact formulas for the expected number of visits and the hitting probabilities on the interval $[0, N]$. From these exact expressions we deduce the formula for the asymptotic behavior of the quantities considered as N goes to infinity.

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