Quadrature Routines for Ladder Variables

Robert W. Keener

Let $T = \inf\{n \geq 1 : S_n > 0\}$ and $H = S_T$ be ladder variables for a random walk $\{S_n\}_{n\geq 1}$ with nonnegative drift. Integral formulas for generating functions and moments of T, H and related quantities are developed. These formulas are suitable for numerical quadrature and should be easier to implement than formulas based on Spitzer's identity when the distribution of S_n is complicated. The approach used makes key use of the Hilbert transform and the main regularity assumption is that some power of the characteristic function for steps of the random walk is integrable.