Matrix representations of Wiener-Hopf Factorizations for Lévy Processes

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Abstract

The Wiener-Hopf factorization of a Lévy process states that the maximum and the displacement from the maximum before an independent exponential time are independent r.v.'s., with the displacement having the same distribution as minus the minimum. It has been used as a computational tool for example for ruin problems, pricing of life insurance products, Russian options, barrier options, Greeks, etc. The majority of explicit solutions assume the upward jumps to be either phase-type or to have a rational Laplace transform, in which case the traditional expressions are lengthy expansions in terms of roots located by means of Rouché's theorem. As an alternative, compact matrix formulas are derived. Computionally, the parameters are evaluated by iteration schemes that work in much higher dimension than the root-finding algorithms.

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Keywords: Phase-type distribution; matrix-exponential distribution; rational Laplace transform; iterative scheme.

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