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Transform-Based Simulations and Option Pricing

When we are given only a transform of a distribution or an option, such as a characteristic function or Laplace transform, it is usually very difficult to conduct simulations. Possible approaches such as numerical inversion of the transforms are computationally very expensive since they are needed essentially for each simulated value. In this paper we explore and compare several alternatives, including simulations directly based on the characteristic function and those which use a saddlepoint approximation obtained from the Laplace transform. We apply these methods to problems in finance including the pricing of options in the Heston stochastic volatility model.