

Pathways to the Toeplitz matrix exponential

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An important structural feature of Toeplitz matrices is that they have low rank representations as solutions of certain matrix Stein or Sylvester equations. Using these low rank properties we present techniques for the computation of the full matrix exponential of a Toeplitz matrix in quadratic complexity, i.e., with run time and storage proportional to the output. An interesting application for our algorithm is the solution of an PIDE arising from option pricing of an asset in Merton's jump diffusion model.