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Padé and Padé-Laplace methods for masses and matrix elements

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The problem of having to reconstruct the decay rates and corresponding amplitudes of the single-exponential components of a noisy multi-exponential signal is common in many other areas of physics and engineering besides lattice field theory, and it can be helpful to study the methods devised and used for that purpose in those contexts in order to get a better handle on the problem of extracting masses and matrix elements from lattice correlators. Here we consider the use of Padé and Padé-Laplace methods, which have found wide use in laser fluorescence spectroscopy and beyond, emphasizing the importance of using robust Padé approximants to avoid spurious poles. To facilitate the accurate evaluation of the Laplace transform required for the Padé-Laplace method, we also present a novel approach to the numerical quadrature of multi-exponential functions.

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