# A Chebyshev-based methodology for pricing European options with arbitrary payoffs

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The well-known representation of the price of a derivative as the risk-neutral expectation of the discounted payoff determines an integral whose solution is the subject of quadrature-based methods for pricing. Starting with the work of Carr and Madan, this numerical approach has received great interest from the computational finance community, and in the last fifteen years the scope for its application has grown significantly.

In this talk we bring together some of Nick Trefethen's favourite tools to propose a quadrature-based Chebfun-inspired methodology for the fast pricing of European options. The flexibility of Chebyshev interpolation allows us to work with arbitrary payoffs and not only vanilla ones. We address two important considerations for the methodology to be useful for practical purposes: the recovery of the underlying's density from the characteristic function, and the estimation of the truncation error. We highlight an important connection between the proposed technique and the very efficient COS method, in which the payoff and density function are approximated by cosine series.

Chebyshev technology remains relatively unknown in the context of mathematical finance but it is an area where it could have multiple applications, and in this talk we highlight related work on global hedging and the fast evaluation of counterparty credit exposures.