

Fast needlet approximation and polynomial evaluation on the sphere

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We present an algorithm and its implementation for fast uniform approximation of functions on the sphere from high degree spherical polynomials. The polynomial degree is in the range from 1,000 to 10,000, where the algorithm is stable. The approximation scheme is based on almost exponentially localized building blocks (polynomial needlets) on the sphere.

A modification of the algorithm is applied to fast evaluation of spherical polynomials at scattered points, where the accuracy is controlled by the uniform norm of the polynomials times a factor in the range of 10^{-6} to 10^{-12} .