Deterministic and probabilistic point sets on the unit sphere

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Abstract

We make a comparison between certain probabilistic (with respect to jittered samplings) and deterministic point sets (spherical t-designs, minimizing point-sets). Also we found the asymptotic equalities for the discrete Riesz s-energy and logarithmic energy of N-point sequence of well separated t-designs on the unit sphere $\mathbb{S}^d \subset \mathbb{R}^{d+1}$, $d \geq 2$. It is shown that asymptotically some deterministic constructions are better or as good as probabilistic ones.

For the classical Sobolev spaces $\mathbb{H}^s(\mathbb{S}^d)$ ($s > \frac{d}{2}$) upper and lower bounds for the worst case integration error of numerical integration on the unit sphere $\mathbb{S}^d \subset \mathbb{R}^{d+1}$, $d \geq 2$, have been obtained by Brauchart, Hesse and Sloan. We investigate the case when $s \to \frac{d}{2}$ and introduce the spaces $\mathbb{H}^{\frac{d}{2},\gamma}(\mathbb{S}^d)$ of continuous functions on $\mathbb{S}^d$ with an extra logarithmic weight. For these spaces we obtain estimates for the worst case integration error.