

# Perturbation of the expected Minkowski functional and its applications

Satoshi Kuriki

*The Institute of Statistical Mathematics*

*E-mail: kuriki@ism.ac.jp*

**Abstract:** The Minkowski functional is a series of geometric quantities including the volume, the surface area, and the Euler characteristic. In this talk, we consider the Minkowski functional of the excursion set (sup-level set) of an isotropic smooth random field on arbitrary dimensional Euclidean space. Under the setting that the random field has weak non-Gaussianity, we provide the perturbation formula of the expected Minkowski functional. This result is a generalization of Matsubara (2003) who treated the 2- and 3-dimensional cases. The Minkowski functional is used in astronomy and cosmology as a test statistic for testing Gaussianity of the cosmic microwave background (CMB), and to characterize the large-scale structures of the universe. Besides, the expected Minkowski functional of the highest degree is the expected Euler-characteristic of the excursion set, which approximates the upper tail probability of the maximum of the random field. This methodology is referred to as the Euler-characteristic method (the expected Euler-characteristic heuristic), and is used in multiple testing problems. We explain some applications of the perturbation formulas in these contexts. (Joint work with Takahiko Matsubara)