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8. Analysis

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Polyhedral harmonic functions and invariant theory

The harmonic functions are precisely those continuous functions which satisfy the mean value property with respect to a ball. What happens if the ball is replaced by a polytope? Our main theorem states that for any n-dimensional polytope P, the set $\mathcal{H}_P$ of all continuous functions satisfying the mean value property with respect to P forms a finite-dimensional linear space of polynomials. The problem of characterizing the function space $\mathcal{H}_P$ is of particular interest when P admits ample symmetry. Then the invariant theory for the symmetry group of P serves as a powerful tool to determine $\mathcal{H}_P$ explicitly. Several examples are also given.

Reference: K. Iwasaki, Polytopes and the mean value property, *Discrete & Comput. Geometry* **17** (1997), 163–189.