

Sum Complexes and their Applications

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The Sum Complex $X_{A,k}$ associated with a subset A of the cyclic group Z_n and an integer $1 \leq k \leq n$ is the $(k-1)$ -dimensional simplicial complex on the vertex set Z_n whose maximal simplices are the sets $\sigma \subset Z_n$ of cardinality k such that $\sum_{x \in \sigma} x \in A$. Sum complexes may be viewed as high dimensional analogues of Cayley graphs over Z_n and are relevant to a number of problems in topological combinatorics. In this talk, we will describe the homology of sum complexes as well as some of their applications, including:

1. Construction of high dimensional trees from sum complexes.
2. Upper bounds on Betti numbers in terms of links, and nearly matching lower bounds via sum complexes.
3. Uncertainty inequalities for the finite Fourier transform and their connections to the topology of sum complexes.

Parts of this talk are based on joint work with Nati Linial and Michael Rosenthal and with Amir Abu-Fraiha.