

Multigraded free resolutions via simplicial collapses

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This talk will be about how discrete homotopy theory can be used effectively to study free resolutions of homogeneous ideals, and more directly, monomial ideals. The root of the approach is in the idea that every monomial ideal has a free resolution – a finite exact sequence of free modules encoding relations between the generators of the ideal – which can be described via topological chain maps of acyclic cell complexes. This approach was introduced by Diana Taylor’s PhD thesis in 1996 and generalized by Bayer and Sturmfels in 1998. Discrete homotopy theory provides tools to change the shape of topological structures while keeping their homological properties intact. In this talk, we will highlight how some of these tools have allowed researchers in commutative algebra to find bounds on the size of free resolutions and the numerical data that come from them. The talk will be aimed at a general audience familiar with definitions of simplicial and cell complexes, as well as ideals in polynomial rings.

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