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Quantifying residual properties of virtually special groups

The subgroup H of the group G is *separable* if for each $g \in G - H$, there exists a finite-index subgroup $G' \leq G$ such that $H \subset G'$ but $g \notin G'$. (When $\{1\}$ is a separable subgroup of G, we say that G is *residually finite*.) A natural question is: what must the index of G' be (in terms of the word-length of g with respect to some finite generating set of G, and reasonable data about H) in order to witness separability of g from H? In the case where $H = \{1\}$, this question is made precise by the *residual finiteness growth* function defined by Bou-Rabee, and more generally there are *separability growth* functions measuring how easy it is to separate elements of G from subgroups in a given class.

Using the *special cube complex* machinery of Haglund-Wise, along with some cubical geometry, we proved, with K. Bou-Rabee and P. Patel, that the residual finiteness growth of a virtually special group (a group with a finite-index subgroup embedding in a right-angled Artin group) is bounded by a linear function of the word length. Patel and I generalized this, quantifying the separability growth function for quasiconvex subgroups of virtually special groups. I will discuss some of the ingredients of the proof and mention some applications. Our results give upper bounds on residual finiteness/separability growth; I will briefly discuss why lower bounds are considerably more difficult to obtain, even in the case where G is a free group.