RESEARCH ABSTRACT

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My research area is *Geometric Group Theory* and *Low-Dimensional Topology*. The following question, due to Gromov, has intrigued me into a couple of past and ongoing projects: does every one-ended word-hyperbolic group contain a surface subgroup?

As a special case, I studied a *Baumslag double*. The *double* of a 2-dimensional CW-complx X is obtained by taking two copies of X, puncturing each of the 2-cells, and gluing along the holes thus obtained. With Sang-il Oum (KAIST), I proved that the fundamental group of the double of every one-ended two-generator presentation complex contains a hyperbolic surface group. This depends on a tool, called *polygonality*, of words in free groups defined by Henry Wilton (University College London) and me.

A related theme is embedability between groups. Using mapping class groups, Thomas Koberda (Yale University) and I studied embeddings between right-angled Artin groups. This study was motivated by the following question: which right-angled Artin groups contain closed hyperbolic surface groups? We combinatorially characterized right-angled Artin subgroups of a given right-angled Artin group; in particular, we determined exactly when there is an embedding from one right-angled Artin group to another in the case where the latter is defined by a triangle–free graph. We also proved that the chromatic number of the defining graph is an obstruction to embedding a right-angled Artin group into a mapping class group. Key ingredients of the proof are realization of right-angled Artin groups as subgroups of mapping class groups and studying the group elements corresponding to pseudo-Anosov elements. Our discovery is the *extension graph*, which "explains" all the right-angled Artin subgroups of a given right-angled Artin group. Koberda and I are working on a project on hyperbolic aspects of right-angled Artin groups, in relation to their actions on extension graphs.

I am also interested in geodesic triangulations of surfaces. In particular, Genevieve Walsh (Tufts University) and I determined when a combinatorial triangulation of a sphere can be realized as an acute geodesic triangulation. This question was answered by deciding when a certain specially metrized Davis complex for a right-angled Coxeter group is CAT(-1). This result yields invariants of triangulations and also leads to the vastly open problem of studying the space of acute geodesic triangulations.

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