Effective methods for subgroup separability and lifting curves simply

Priyam Patel, Purdue University

The fundamental groups of hyperbolic surfaces and 3-manifolds have various algebraic finiteness properties, two of which are residual finiteness and subgroup separability. Effective or algorithmic proofs of these properties help us "quantify" separability. I will give a brief overview of some results in this direction before focusing on an important topological implication of subgroup separability for surface groups; the ability to lift any closed curve to a simple closed curve in a finite cover of the surface. In particular, I will discuss recent joint work with T. Aougab, J. Gaster, and J. Sapir answering the following quantitative question: what is the minimal degree of a cover in which a given closed curve on a surface lifts to a simple closed curve (i.e. lifts simply)? An important aspect of our work that I hope to highlight involves building a hyperbolic metric for a closed curve on a surface that yields an interesting relationship between its length and self-intersection number.