

DEFENSE OF THE DOCTORAL DISSERTATION

DEPARTMENT OF MATHEMATICS

“Local Euler Obstructions and Chern-Mather Classes on Schubert Varieties”



Paul LeVan

Friday, May 5, 2023

Time: 2:00 PM

Location: 125 Hayes-Healy Bldg.

Examination Committee:

Claudiu Raicu, Advisor

Sam Evens

Eric Riedl

Claudia Polini



Abstract:

An important open question in the study of singularities of algebraic varieties is to calculate the Chern–Schwartz–MacPherson and Chern–Mather characteristic classes. In the setting of the Schubert stratification of partial flag varieties, results for the Chern–Mather classes are known only in a few settings, namely in Grassmannians of cominiscule type. In the study of Chern–Mather classes, local Euler obstructions are introduced. As noticed in the work of Mihalcea and Singh, these classes satisfy some surprising positivity properties. This thesis is dedicated to studying a framework for calculating these objects outside of the cominiscule case. The strategy is to use the well-behaved geometry of the Bott–Samelson resolutions on complete flag varieties, as well as a flat degeneration of this resolution to toric varieties, where computations are more well behaved. We end with some concrete calculations appearing in joint work with Claudiu Raicu, in the case of Lagrangian Grassmannians. In this special case of a cominiscule Grassmannian, we were able to prove the last remaining part of the positivity conjecture of Mihalcea–Singh as well as realizing the local Euler obstructions as a non-negative count of natural combinatorial objects.