

# Research Proposal: Matrix Representations of the Alexander Polynomial of a Link

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## 1 Prior Work

My prior work pertaining to this project consists of study in the areas of Abstract Algebra and Knot Theory. I have taken Math 171 (Abstract Algebra I), Math 172 (Abstract Algebra II), and Math 148 (Knot Theory) through Harvey Mudd College. I also hope to complete Knot Theory Research over the summer at the Claremont Math REU.

## 2 Intended Reading

Over the next few months I will read several relevant sections of Dummit and Foote [4] and Livingston [3] to reacquaint myself with the basics of Module Theory and derivations of the Alexander Polynomial, as well as studying papers by de Rham [1] and Crowell [2] that are relevant to my thesis work closely. Furthermore I will familiarize myself with any papers that are similarly relevant to my thesis.

## 3 Proposed Research

In [1] a method of finding the Alexander polynomial and elementary ideals of a knot using a homomorphism between the fundamental group of the knot and the group of similarity transforms of a plane is discussed. I intend to extend this method to be defined over links. This will involve working with fundamental groups with more conjugacy classes and a multi-variable Alexander Polynomial. Finding the appropriate group of matrices will open up new ways of looking at questions about how the Alexander Polynomials of the components of the link are related to the Alexander Polynomial of the link. Since this is an unexplored view of the link it has the possibility of opening up new questions and giving a clearer understanding of the relations in and between links.

## References

- [1] George de Rham, *Introduction aux Polynomes d'un Nœud*, Enseignement Math. (2), 13 (1967) pp. 187-194.
- [2] R. H. Crowell, *The Group  $G'/G''$  of a Knot Group  $G$* , Duke Math. J., 30 (1963) pp. 349-354.
- [3] Charles Livingston, *Knot Theory*, The Mathematical Association of America, 1993.
- [4] David S. Dummit & Richard M. Foote, *Abstract Algebra: Third Edition*, John Wiley & Sons, Inc., 2004