UNIVERSITY OF TORONTO
FACULTY OF ARTS & SCIENCE | Department of Mathematics

Departmental PhD Thesis Exam

Wednesday, June 26th, 2024 at 10:00 a.m. (sharp)
via BA6183 / Zoom

PhD Candidate: Keirn Munro

Supervisor: Marco Gualtieri

Thesis title: Simplicial Approximation of the Hodge Laplacian Using Cauchy Sequences of Hilbert Complexes

Abstract

Discrete differential geometry arises from the use of discrete spaces such as graphs, simplicial, cubical, or polyhedral complexes for modeling geometric structures on manifolds. A common practice in this work is to transport structures on smooth manifolds to discrete counterparts in a process referred to as *discretization*. Discretizations often appear as elements of a sequence that approximates the smooth structure on the manifold through some measure of convergence. Algorithms which produce such sequences are highly sought after for computational applications but frequently ignore deeper structural relationships between successive discrete models.

This thesis makes contributions to the discretization of Hodge theory through the construction of a framework that serves to axiomatize a foundational set of results in the field. The salient feature of this framework is the ability to directly measure the difference in approximation accuracy between discretizations without reference to the overarching smooth structure. This provides a Cauchy-type characterization of sequences of discretizations while opening the scope of inquiry to a much larger class of problems involving the analysis of Hodge Theory through Cauchy sequences.