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*Möbius Inversions and Persistent Homology*

Single parameter persistent homology is the study of the birth and death of cycles in a filtration of a space. Over the past decade or so, a rigorous theory of persistent homology has been developed over coefficients in any field. In this case, the algebraic object of study becomes a finitely generated module over a PID. The persistence diagram, which is the invariant that captures the history of births and deaths, is defined as its set of indecomposables. For coefficients in an arbitrary ring, the associated module is not over a PID and this theory fails to produce a persistence diagram. Recently, we have been developing a new theory for persistent homology using the Möbius inversion formula. We have a well defined notion of a persistence diagram for coefficients over any ring. Furthermore, bottleneck stability, which is the main theorem in persistent homology, holds in this more abstract setting. We are now exploring ways to extend this theory to the multifiltration setting with some success. In this talk, I will summarize what we know and discuss open problems.