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GEOMETRIC EXTENSIONS AND THE SIX FUNCTOR FORMALISM

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The results in this thesis are linked by their use of the six functor formalism. In the first chapter, we introduce geometric extensions, canonical sheaves on singular varieties characterised by their occurrence as a summand of the cohomology of any resolution of singularities. These objects generalise intersection cohomology, parity sheaves and provide a definition of intersection K-theory. This work has appeared in [1]. In the second chapter, we interpret this construction in the context of real algebraic varieties. This leads to a real interpretation of the mod two Hecke category and supplies a definition of mod two intersection homology groups on real algebraic varieties, answering an old question of Goresky and MacPherson. This is the subject of the preprint [2]. In our third chapter, we give a string diagrammatic interpretation of various maps in the six functor formalism. This graphical calculus leads to the proof of a general coherence theorem. While this theorem does not incorporate the monoidal aspects of the theory, it gives the first coherence result in a six functorial context that treats all four functors f_*, $f_!$, f^*, $f^!$, along with the natural transformations between them.

References

[1] C. Hone and G. Williamson, 'Geometric extensions', *Int. Math. Res. Not. IMRN* **2025**(11) (2025), Article no. maf141.

[2] C. Hone, 'Real algebraic varieties and their intersection cohomology', Preprint, 2026, arXiv:260609149.

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