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Preface

This thesis consists of two parts. In Part I a homology theory for isolated invariant sets of flows on finite dimensional manifolds is developed, and in Part II criteria for the existence of periodic orbits on non-compact hypersurfaces in Hamiltonian dynamics are found. The main connection between the two parts is the use of Morse theory in the study of dynamical systems. In Chapter 1 we give an overview of the setting and the history of the subjects, and discuss the results of this thesis more in depth. In Chapter 2 we define Morse-Conley-Floer homology and prove some of its basic properties. This chapter is based on [RV14b]. In Chapter 3 we treat functorial aspects of Morse homology, local Morse homology, and Morse-Conley-Floer homology, and in Chapter 4 we study Poincaré duality and some algebraic structures in these homology theories. These chapters are based on [RV14a]. We apply Morse-Conley-Floer homology to the study of Morse decompositions and degenerate variational systems in Chapter 5. Part II, Chapter 6, is concerned with the existence of periodic orbits on non-compact energy hypersurfaces. We give topological and geometric criteria for the existence of such periodic orbits. Chapter 6 is based on [VDBPRV13].