## Contents

Chapter 1. Introduction 1

Chapter 2. Differential function spectra 7  
  2.1. Differential cohomology – the axioms 7  
  2.2. The construction of the differential function spectrum 11  
  2.3. Homotopy groups and long exact sequences 19  
  2.4. Differential Data and Transformations 23

Chapter 3. Cycle maps 27  
  3.1. Introduction 27  
  3.2. Complex $K$-theory – a warm-up 27  
  3.3. The spectrum $KR$ 31  
  3.4. The topological cycle map 33  
  3.5. Kamber-Tondeur forms 37  
  3.6. Borel’s regulator 42  
  3.7. Characteristic forms 45  
  3.8. The cycle map for geometric locally constant sheaves 50  
  3.9. Some calculations with $KR^0(\ast)$ 52  
  3.10. Extension of the cycle maps from projective to finitely generated $R$-bundles 55

Chapter 4. Transfers in differential cohomology 67  
  4.1. Introduction 67  
  4.2. Differential Becker-Gottlieb transfer 67  
  4.3. Geometric bundles and integration of forms 70  
  4.4. Transfer structures and the Becker-Gottlieb transfer 73  
  4.5. The left square in (4.8) and the construction of $\tilde{t}r$ 77  
  4.6. Proof of (4.6) 83  
  4.7. Functoriality of the transfer for iterated bundles 84

Chapter 5. A transfer index conjecture 89  
  5.1. Introduction 89  
  5.2. The statement of the transfer index conjecture 89  
  5.3. The analytic index 92  
  5.4. Discussion of the transfer index conjecture 94  
  5.5. Discussion of Lott’s relation 113

Chapter 6. Technicalities 117  
  6.1. Categories with weak equivalences and $\infty$-categories 117  
  6.2. Commutative algebras and monoids 124
6.3. Smooth objects 128
6.4. Homotopy invariance 136
6.5. The de Rham complex 142
6.6. Function spectra with proper support 148
6.7. Thom and Euler forms 165
6.8. The normalized Borel regulator map 167
6.9. More normalizations 172

Bibliography 175