

TABLE OF CONTENTS

Chapter I. <u>Structure of Cohomology Theories</u>	1
Section A. <u>Axiomatics</u>	1
1. Three Theorems.....	1
2. Reduced Cohomology Theories.....	3
3. Spectra.....	9
Section B. <u>Spectral Sequence of a Fibration</u>	13
1. Exact Couples.....	13
2. Spectral Sequence of a h^* -fibration.....	16
3. Applications of the Spectral Sequence.....	25
4. The "Universal Cohomology Theory".....	27
Section C. <u>Multiplicative Cohomology Theories</u>	31
1. Preliminaries.....	31
2. Dold-Thom-Gysin Theorem.....	37
3. Orientability of Bundles.....	40

Section D.	<u>Applications to Differential Manifolds.</u>	47
1.	Orientations of Manifolds and the Umkehr Homomorphism.....	47
2.	Multiplicative Transformations; Riemann- Roch Theorem.....	58
3.	Wu Formulas.....	66
Chapter II.	<u>Complex Vector Bundles and the Bott Periodicity Theorem.....</u>	70
Section A.	<u>Bott Periodicity Theorem.....</u>	70
1.	Homology of the Unitary Groups.....	70
2.	The Universal Base Spaces $BU(n)$	78
3.	The Bott Periodicity Theorem for BU	84
Section B.	<u>Complex Vector Bundles.....</u>	90
1.	Characteristic Classes.....	90
2.	Complex Vector Bundles over Spheres.....	96
Chapter III.	<u>The Cohomology Theory</u> $K_{\mathbb{C}}^*$	112
Section A.	<u>Basic Properties of</u> $K_{\mathbb{C}}^*$	112
1.	Definition of $K_{\mathbb{C}}^*$	112
2.	The Multiplicative Transformation $ch: K_{\mathbb{C}}^* \rightarrow H^{**}(\ ; \mathbb{Z})$	118
3.	Cohomology Operations in $K_{\mathbb{C}}^*$	122
4.	$K_{\mathbb{C}}^*$ -orientation of Complex Vector Bundles..	126

Chapter IV. <u>Some Geometric Applications</u>	132
Section A. <u>Vector Bundles over Cell Complexes</u>	
$S^n \cup e^m$	132
1. Two technical lemmas.....	132
2. Divisors of Orders of Stable Homotopy Classes, J-homomorphisms.....	135
3. Maps of Hopf Invariant One.....	140
Section B. <u>Toda Brackets</u>	144
Appendix 1.	
Section A. The Cohomology Theory $K_{\mathbb{R}}^*$	149
Pontrjagin Classes.....	149
\hat{A} Functions.....	156
Section B. Representations of Lie Groups.....	156
Orientations in $K_{\mathbb{C}}^*$	156
Appendix 2.	
A Multiplication Formula.....	165
Appendix 3.	
Fiber Homotopy Equivalence of Bundles, The Groups $J(X)$	168
Historical Comments.....	178
Bibliography.....	181