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of Up zero(V) Up; 4.5 Harmonic Oscillators on Euclidean Spaces; 4.6 A Proof of the Poincare-Hopf Index Formula; 4.7 Some Estimates for DT,  $i$ 's,  $2i$ ; 4.8 An Alternate Analytic Proof; 4.9 References; Chapter 5 Morse Inequalities: an Analytic Proof; 5.1 Review of Morse Inequalities; 5.2 Witten Deformation; 5.3 Hodge Theorem for  $(\ast(M), dTf)$ ; 5.4 Behaviour of  $\text{rf}$  Near the Critical Points of  $f$ ; 5.5 Proof of Morse Inequalities; 5.6 Proof of Proposition 5.5; 5.7 Some Remarks and Comments; 5.8 References; Chapter 6 Thom-Smale and Witten Complexes; 6.1 The Thom-Smale Complex; 6.2 The de Rham Map for Thom-Smale Complexes; 6.3 Witten's Instanton Complex and the Map  $eT$ ; 6.4 The Map  $P, TeT$ ; 6.5 An Analytic Proof of Theorem 6.4; 6.6 References; Chapter 7 Atiyah Theorem on Kervaire Semi-characteristic; 7.1 Kervaire Semi-characteristic; 7.2 Atiyah's Original Proof; 7.3 A proof via Witten Deformation; 7.4 A Generic Counting Formula for  $k(M)$ ; 7.5 Non-multiplicativity of  $k(M)$ ; 7.6 References; Index

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Sommario/riassunto

This invaluable book is based on the notes of a graduate course on differential geometry which the author gave at the Nankai Institute of Mathematics. It consists of two parts: the first part contains an introduction to the geometric theory of characteristic classes due to Shiing-shen Chern and Andre Weil, as well as a proof of the Gauss-Bonnet-Chern theorem based on the Mathai-Quillen construction of Thom forms; the second part presents analytic proofs of the Poincare-Hopf index formula, as well as the Morse inequalities based on deformations introduced by Edward Witten. <br><i>Contents:</i>

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