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Nota di contenuto	Contents; Contributors; Introduction; 1 A brief introduction to Dirac manifolds; 1.1 Introduction; 1.1.1 Notation, conventions, terminology; 1.2 Presymplectic and Poisson structures; 1.2.1 Two viewpoints on symplectic geometry; 1.2.2 Going degenerate; 1.3 Dirac structures; 1.4 Properties of Dirac structures; 1.4.1 Lie algebroid; 1.4.2 Presymplectic leaves and null distribution; 1.4.3 Hamiltonian vector fields and Poisson algebra; 1.5 Morphisms of Dirac manifolds; 1.5.1 Pulling back and pushing forward; 1.5.2 Clean intersection and smoothness issues 1.6 Submanifolds of Poisson manifolds and constraints1.6.1 The induced Poisson bracket on admissible functions; 1.6.2 A word on coisotropic submanifolds (or first-class constraints); 1.6.3 Poisson-Dirac submanifolds and the Dirac bracket; 1.6.4 Momentum level sets; 1.7 Brief remarks on further developments; Acknowledgments; References; 2 Differential geometry of holomorphic vector bundles on a curve; 2.1 Holomorphic vector bundles on Riemann surfaces; 2.1.1 Vector bundles; 2.1.2 Topological classification; 2.1.3 Dolbeault operators and the space of holomorphic structures; 2.1.4 Exercises 2.2 Holomorphic structures and unitary connections2.2.1 Hermitian metrics and unitary connections; 2.2.2 The Atiyah-Bott symplectic form; 2.2.3 Exercises; 2.3 Moduli spaces of semi-stable vector bundles; 2.3.1 Stable and semi-stable vector bundles; 2.3.2 Donaldson's theorem; 2.3.3 Exercises; References; 3 Paths towards an extension of Chern-Weil calculus to a class of infinite dimensional vector bundles; Introduction; Part 1: Some useful infinite dimensional Lie groups; 3.1 The gauge group of a bundle; 3.2 The diffeomorphism group of a bundle 3.3 The algebra of zero-order classical pseudodifferential operators3.4 The group of invertible zero-order dos; Part 2: Traces and central extensions; 3.5 Traces on zero-order classical dos; 3.6 Logarithms and central extensions; 3.7 Linear extensions of the L2-trace; Part 3: Singular Chern-Weil classes; 3.8 Chern-Weil calculus in finite dimensions; 3.9 A class of infinite dimensional vector bundles; 3.10 Frame bundles and associated do-algebra bundles; 3.11 Logarithms and closed forms; 3.12 Chern-Weil forms in infinite dimensions; 3.13 Weighted Chern--Weil forms; discrepancies 3.13.1 The Hochschild coboundary of a weighted trace3.13.2 Dependence on the weight; Part 4: Circumventing anomalies; 3.13.3 Exterior differential of a weighted trace; 3.13.4 Weighted traces extended to admissible fibre bundles; 3.13.5 Obstructions to closedness of weighted Chern--Weil forms; 3.14 Renormalised Chern-Weil forms on do Grassmannians; 3.15 Regular Chern-Weil forms in infinite dimensions; Acknowledgements; References; 4 Introduction to Feynman integrals; 4.1 Introduction; 4.2 Basics of perturbative quantum field theory; 4.3 Dimensional regularisation 4.4 Loop integration in D dimensions
Sommario/riassunto	Based on lectures given at the renowned Villa de Leyva summer school, this book provides a unique presentation of modern geometric methods in quantum field theory. Written by experts, it enables readers to enter some of the most fascinating research topics in this subject. Covering a series of topics on geometry, topology, algebra, number theory methods and their applications to quantum field theory, the book covers topics such as Dirac structures, holomorphic bundles and

stability, Feynman integrals, geometric aspects of quantum field theory and the standard model, spectral and Riemannian geometry and index theory. This is a valuable guide for graduate students and researchers in physics and mathematics wanting to enter this interesting research field at the borderline between mathematics and physics.