

Preface

The main purpose of the present notes is to give a systematic approach to conformal field theory with gauge symmetry, the so called the Wess-Zumino-Witten-Novikov model from the viewpoint of complex algebraic geometry. After presenting basic facts on the theory of compact Riemann surfaces, and on the representation theory of affine Lie algebras in Chapters 1 and 2, respectively, we shall construct conformal blocks for stable pointed curves with coordinates in Chapter 3. In Chapter 4 we shall construct the sheaf of conformal blocks associated to a family of stable pointed curves with coordinates. In Chapter 5 it will be shown that the sheaf of conformal blocks carries a projectively flat connection, which is one of the most important facts of conformal field theory. Chapter 6 is devoted to study the detailed structure of the conformal field theory over \mathbb{P}^1 .

Recently J.E. Andersen and I constructed modular functors from conformal field theory. This gives an interesting relationship between Algebraic Geometry and Topological Quantum Field Theory. The present notes include all the necessary techniques and results on conformal field theory with gauge symmetry, which are used to construct the modular functor.

The present notes are based on the lectures and talks given at the Fields Institute, Queen's University, Århus University, Kobe University and Kyoto University. I thank the enthusiastic audiences who helped me to improve certain parts of the proofs in these notes.

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