Eighth International Conference on
Geometry, Integrability and Quantization
June 9–14, 2006, Varna, Bulgaria
Ivaïlo M. Mladenov and Manuel de León, Editors
SOFTEX, Sofia 2007, pp 207–220

MORSE THEORY IN FIELD THEORY

PETER KOROTEEV

Institute for Theoretical and Experimental Physics
117259 Moscow, Russia

Abstract. We describe a geometrical interpretation of Topological Quantum Mechanics (TQM). Basics of the general topological theories are briefly discussed as well. The appropriate correspondence between objects of TQM and the algebraic topology is pointed out. It is proved that the correlators in TQM can be expressed via intersection numbers of some submanifolds of the target space with paths of steepest descent between critical points. Another correspondence is only conjectured, namely the correspondence between correlators and an integral of Massey products on cohomology classes of the target manifold.

Introduction

Topological Quantum Field Theories (TQFT) and Topological String Theories originating from the works of Witten *et al* [8–10] may be helpful in searches for the truly fundamental physical theory and in the treatment of important mathematical problems.

The main feature of topological theories is the independence of the correlation functions on metrics and coordinates [1]. In **Topological Field Theories** (TFT) there are no propagating (local) degrees of freedom, the vacuum expectation values of operators and transition amplitudes (both further referred to as "correlators") depend only on topology of the target manifold.

In this paper we employ for our purposes a simple example of Topological Field Theory – **Topological Quantum Mechanics** (TQM) with a BRST-like invariant action. It was already shown [2, 4] that in zero-dimensional analog of this theory partition function is equal to the Euler character of the target manifold.

We have two main aims: the first is to make manifest the correspondence between TFT and geometry of target manifold, and the second one is to study the correspondence between TFT and a differential graded algebra of cohomology classes