

## Floer Homology for Oriented 3-Manifolds

Kenji Fukaya

*Dedicated to Professor Akio Hattori on his sixtieth birthday*

### Contents

§ 1	Introduction
§ 2	Perturbation
§ 3	Local structure of moduli space
§ 4	Sum formula for index bundles
§ 5	Dimension of moduli space
§ 6	Orientation of moduli space
§ 7	Partial compactification of moduli space
§ 8	Taubes construction
§ 9	Decay estimate
§10	Local action on the end of moduli space
§11	Extension of the line bundle to the boundary
§12	Boundary operators
§13	Independence of the metrics and the perturbations

### §1. Introduction

In [F], A. Floer introduced a new invariant for homology 3-spheres. In this paper we generalize his invariant to arbitrary closed and oriented 3-manifolds. In the case when the first homology group of the manifold is torsion free and nonzero, we also define invariants  $I_k^s(M)$  for  $s < 3$ , which, in the case  $s = 0$ , is a generalization of Floer's one. The construction of this invariant is closely related also to the Donaldson's polynomial for closed 4-manifolds [D4]. The construction is based on the study of the moduli space of selfdual connections over  $M \times \mathbf{R}$  and its compactification.

---

Received December 12, 1989.

A part of this paper is written during the authors stay in University of Maryland, College Park Campus.