W. M. Mikulski
Nagoya Math. J.
Vol. 140 (1995), 117–137

THE GEOMETRICAL CONSTRUCTIONS LIFTING TENSOR FIELDS OF TYPE (0,2) ON MANIFOLDS TO THE BUNDLES OF A-VELOCITIES

W. M. MIKULSKI

0. Introduction

Let A be a Weil algebra. The fibre bundle $T^A M$ of A-velocities over a manifold M was described by A. Morimoto [15] as another description of the bundle of near A-points by Weil [17]. In [4] for any tensor field τ of type (0,2) on M and any functional $\lambda \in A^*$ we have defined the so called λ-lift of τ to $T^A M$. We recall this construction in Example 1.3. The λ-lift of τ is a naturally induced tensor field of type (0,2) on $T^A M$.

In this paper we study the problem how a tensor field of type (0,2) on M can induce tensor fields of types (0,1) and (0,2) on $T^A M$. In Section 1 we present some constructions of such type. Some new lifts of tensor fields of type (0,2) to $T^A M$ are presented. In Section 2 we remark that the idea of such constructions is reflected in the concept of natural operators $T^{(0,2)} \to T^{(0,1)} T^A$ and $T^{(0,2)} \to T^{(0,2)} T^A$, cf. [6]. The rest of the paper is dedicated to the proof of the following classification theorems.

THEOREM 0.1. *Let A be a Weil algebra with p variables. For n-manifolds ($n \geq p + 2$), the space of all natural operators $T^{(0,2)} \to T^{(0,1)} T^A$ is a free finitely generated module over $C^\infty(S^A)$, where S^A is a finite dimensional vector space depending canonically on A.*

THEOREM 0.2. *Let A be a Weil algebra with p variables. For n-manifolds ($n \geq p + 3$), the space of all natural operators $T^{(0,2)} \to T^{(0,2)} T^A$ is a free finitely generated module over $C^\infty(S^A)$, where S^A is a finite dimensional vector space depending canonically on A (the same as in Theorem 0.1).*

Received March 25, 1994.