

## ALMOST COMPLEX STRUCTURES INDUCED IN TANGENT BUNDLES

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**Introduction.** The differential geometry of tangent bundles of Riemannian manifolds has been studied by Sasaki [5]<sup>1)</sup> and the theory of affine connections in tangent bundles of manifolds with affine connection by Ledger and one of the present authors [3], [15].

Kobayashi and one of the present authors [13], [14] recently studied prolongation of tensor fields and connections to tangent bundles. They first developed the general theory of prolongation of tensor fields and affine connections to tangent bundles and then studied affine transformations in tangent bundles.

The main purpose of the present paper is to study the prolongation of the so-called  $f$ -structure to tangent bundles and especially that of almost contact structure in the light of the above mentioned papers by Kobayashi and one of the present authors.

In Sections 1 and 2, we recall some results stated in [13] and [14] which are indispensable in the subsequent sections.

In Section 3, we study the so-called  $f$ -structure and its prolongation to the tangent bundle. To study the properties of the so-called  $f$ -structure, we introduce a frame closely related to the  $f$ -structure. We study these in Section 4.

The last section is devoted to the study of prolongation of the so-called almost contact structure which is an  $f$ -structure. The results obtained in this section are closely related to those obtained recently by Tanno [9], [10].

### CONTENTS

- § 1. Lifts of tensor fields.
- § 2. Almost complex structures.
- § 3.  $f$ -structures.
- § 4. Frames and Lie groups.
- § 5. Almost contact structures and framed  $f$ -structures.

#### § 1. Lifts of tensor fields.

We first recall definitions and properties of the vertical lift and the complete

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1) The number in brackets refers to the References at the end of the paper.