

# Algebraic Study of Chiral Anomalies<sup>\*</sup>

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**Abstract.** The algebraic structure of chiral anomalies is made globally valid on non-trivial bundles by the introduction of a fixed background connection. Some of the techniques used in the study of the anomaly are improved or generalized, including a systematic way of generating towers of “descent equations”.

## I. Introduction

Chiral anomalies have been studied at a slow pace over a period of almost fifteen years during most of which the general lack of interest following the active pioneering period [1, 2, <sup>1</sup>] did not stimulate very active efforts [3–6]. Recent revival [7, 8] of the subject has, however, encouraged us [9–13] to develop further some of the methods which slowly emerged and cast the results into a form suitable to make contact with the recent mathematical understanding of the connections between some of the algebraic structures which have been discovered and the topology of gauge field orbit spaces and of gauge groups [14–19].

In this paper, we shall limit ourselves to the algebraic aspects of the structure of chiral anomalies, but, by introduction of a background field (fixed connection), we shall extend the local results so far obtained in such a way that they become globally valid on non-trivial bundles. This gives new insight into the problem and is also of physical interest, in particular in the gravitational case, when non-parallelizable manifolds are considered [20, 21].

Section II is devoted to the description of the main two technical tools to be used in the sequel: the “Russian” formula and the extended Cartan homotopy

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<sup>1</sup> The pioneering period is extensively covered in [1]. From this period, we shall however select out [2], especially relevant to the subject of this paper