# The Topological Whitehead Torsion of an Equivariant Fiber Homotopy Equivalence

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## Introduction

In this paper we compute the topological equivariant torsion of an equivariant fiber homotopy equivalence between compact equivariant ANRs. Throughout this paper, $G$ denotes a finite group. Let $p: E \to B$ and $p': E' \to B'$ be locally trivial $G$-fibrations between compact $G$-ANRs such that the fibers are equivariant compact ANRs. Let

$$\begin{array}{ccc} E' & \xrightarrow{h} & E \\ {\scriptstyle p'}\downarrow & & \downarrow{\scriptstyle p} \\ B' & \xrightarrow{f} & B \end{array} \qquad (*)$$

be a $G$-fiber homotopy equivalence over the $G$-homotopy equivalence $f$. Then we compute the topological torsion of $h$ using the torsion of the pull-back of $f$ and the fiberwise action of the equivariant Euler characteristic of $B'$ to the torsion of the fibers (Theorem 6.5). This result generalizes the main theorems in [1], [2], and [7].

The structure of the paper is as follows: In Section 1 we summarize the properties of compact $G$-ANRs and $G$-CE maps between them. In Section 2 we recall the definition of the topological torsion of a $G$-homotopy equivalence between compact $G$-ANRs and we prove the composition and the sum formula. In Section 3 we summarize the theory of functorial additive invariants [6, Chap. IV; 11, §6]. As an application of this theory we prove the product formula for the topological torsion following the lines of proof of Theorem 6.11 in [11]. This product formula generalizes the one given in the cellular case in [8] and [13]. In Section 4 we define the pull-back map $p^*$: $\mathrm{Wh}_G^{\mathrm{Top}}(B) \to \mathrm{Wh}_G^{\mathrm{Top}}(E)$ determined by a locally trivial $G$-fibration $p: E \to B$ between compact $G$-ANRs. The definition and the properties of $p^*$ are analogous to the ones proven in [2] for $G = 1$. In Section 5 we define the fiberwise product of the Euler characteristic of $B'$ with the torsions of the homotopy equivalences of the fibers determined by $(*)$. In Section 6 we complete the computation of the topological torsion of $h$. We first give the proof for the special case that $B$ is a finite $G$-complex. Using the fact that every compact

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